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XX.

THE TREATMENT OF CANCER OF THE LARYNX.\*

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VIENNA.

AN ADDRESS DELIVERED BEFORE THE AMERICAN LARYNGOLOGICAL,  
RHINOLOGICAL AND OTOLOGICAL SOCIETY, AT  
ATLANTIC CITY, JUNE, 1909.

*Mr. President and Gentlemen:—*

It is with great pleasure that I comply with your request to deliver an address before the American Laryngological, Rhinological and Otological Society, for this association includes among its members some of the most prominent and celebrated men in our special line of work. In spite of my many heavy duties arising from my position as official Instructor in Laryngo-Rhinology in the University of Vienna, I concluded to accept this most distinguished invitation.

\*Translated by Hanau W. Loeb, M. D., St. Louis.

I have selected as the subject of my address, "The Treatment of Cancer of the Larynx," a disease which, before the invention of the laryngoscope, was only superficially known and but seldom subjected to therapeutic attention. The new method of examination resulted first in a more intimate acquaintance with the disease, made an earlier diagnosis possible, and brought out a rational therapy.

The importance of therapeutic activity against this disease depends upon the terrible fate which awaits the victims who are not treated early. Each one of you has certainly been forced to stand by, helpless, while your patient with inoperable cancer of the larynx journeyed to his distressing end. The suffering of these patients is much greater than that of others who have cancer in other parts of the body. In addition to the pain, cachexia and symptoms and fear of the spreading of the cancer to other parts of the body, there are added symptoms resulting from interference with speech, respiration, and deglutition. And while the interference with respiration may be for the moment stayed by tracheotomy, early or late in the disease, it may make its appearance again through the growth of the cancer into the trachea. Besides, deglutition may become more difficult by involvement of the esophagus and thereby make the patient's life unbearable.

It is remarkable how long, comparatively, these patients may remain in this stage without being delivered from their terrible suffering, by an inflammation of the lung or a toxic condition of the blood. They generally succumb to the ever-increasing weakness from disturbed nutrition and frequently recurring hemorrhages. On this account, any effort to cure cancer of the larynx is a real blessing to suffering humanity, and a surgeon is likewise obliged to undertake serious operations if there is merely a prospect for radical cure.

In reviewing the several methods of relief, we should discuss the prophylaxis, the causal therapy, and then the operative methods and all the means directed against the various symptoms.

Prophylaxis would be of some value if we knew the cause of carcinoma. We may, however, state with great reserve that continued irritation of the mucosa of the larynx—for instance, by excessive smoking and drinking,—and, in addition, recurring catarrh, syphilis, (especially according to Esmarch's observations), and, finally, heredity are to be con-

sidered as probable causes of cancer of the larynx. With the exception of these, the whole power of the physician avails practically nothing as to the cause.

The causal therapy should be directed against the bacterial and protozoic cause of cancer which has been extensively studied up to the present time, but without result. The investigations depend upon the effort to cure the disease by the injection of cancer serum. (Adamkiewicz and Coley.) But, up to the present time, all of these attempts have proved unsuccessful.

The use of the Roentgen rays gave much hope in the beginning; certainly these rays have a specific action upon malignant neoplasms, but, until now, it has not been possible to apply them so as to cure the disease in this way. Gradenigo, in his paper before the International Congress of Laryngorhinology at Vienna in 1908, reported that a careful study of the entire literature revealed that all attempts to cure cancer of the larynx by Roentgen rays had, up to the present time, been in vain. For this reason, no time should be lost with this agent, but early surgical procedure should be undertaken wherever possible.

On the other hand, the Roentgen rays appear to be of value in inoperable cases, especially when the larynx is opened and the rays permitted to act directly on the cancer. The same observation was made by D. Bryson Delavan, in 1902, and his views presented at that time, and in 1903, before the American Laryngological Association, were concurred in by Ingals, Payson Clark, Leland, Ames, Bliss, Swain, Birkett, and Simpson. Most of the discussants emphasized the fact that in inoperable cancer the X-rays reduce or dissipate the pain and stop the growth of the neoplasms. Dr. Cott (Bryson Delavan—Meeting 1904, p. 152) was able to cure completely a cancer recurrence of the larynx by sixteen applications of the X-rays, so that there was no evidence of the growth seventeen months later. On the other hand, Lincoln reported, in 1903, a case in which the use of the X-rays resulted in necrosis and extrusion of the epiglottis and both wings of the thyroid, causing death of the patient from pulmonary inflammation.

The use of radium has given exactly similar results as shown by Gradenigo in his report made at Vienna in 1908.

Dawburn's method of influencing cancer of the larynx by ligature of the carotid is also considered by Delavan to be of value only in inoperable cases.

Clarence C. Rice reported, in 1906, a case of carcinoma of the vocal band, which was treated with subcutaneous injections of trypsin (Fairchild's) and with the internal administration of holadin. The growth was thereby reduced to one-quarter of its size, but this portion remained.

Finally, Czerny (XV meeting of the Verein deutscher Laryngologen, June 8, 1908) employed fulguration in the year 1908. He removed a carcinoma of one of the cords by thyrotomy and permitted sparks of electricity of high frequency and high tension to play upon the surface of the wound for five minutes. Czerny is inclined to ascribe to fulguration a positive influence in preventing recurrence.

From this short review it is evident that none of the methods of treatment mentioned has, up to the present time, resulted in positive cure of cancer of the larynx, and that on this account we must lose but little time in operable cases. On the other hand, these methods have value, perhaps, in preventing recurrences, or, at least, in relieving sufferings and symptoms in the inoperable cases.

The surgical methods alone remain as of demonstrated value in cancer of the larynx, as these methods alone can show undoubted cures of long duration.

The results of extirpation of cancer of the larynx are, as a rule, better than in cancer in other parts of the body. The basis of this—which I need hardly bring before this meeting of distinguished professional men—depends principally upon the fact that cancer begins generally upon the inside of the larynx, as reported by Krishaber, in 1879. The designation, intrinsic, and extrinsic cancer originated with him.

Intrinsic cancer generally affects the vocal band and in this way causes hoarseness, which induces the patient to consult a laryngologist early in the disease; more uncommonly it is located on the ventricular bands, in the ventricle, or below the glottis; in any event it has the special characteristic of not infecting the lymph nodes of the vicinity in the earlier stages and even late in the disease.

The early removal of such an intrinsic cancer results generally in radical cure. Extrinsic cancers, on the other hand, which lie about the margins of the larynx, affect the lymph nodes much earlier and give, therefore, a much graver prognosis, even if I cannot quite agree with Delavan, who said, in 1904, "Extrinsic laryngeal carcinoma is practically incurable by operations," inasmuch as some cures are reported.

A positive estimate of the value of the surgical operative methods can only be determined by reliable statistics. The value of statistics is always properly subject to doubt, as the elements of error cannot be fully eliminated. Errors are most frequently found in the statistics of the results of operative methods in general and especially in those pertaining to cancer of the larynx. As cancer of the larynx is an uncommon affection, many busy surgeons and laryngologists with large practices see few cases and operate on still fewer. This and other sources of error were brought forward by Semon in Fränkel's Archiv. in 1897, and by Delavan at the 22nd Annual Meeting of the American Laryngological Association, in 1900. I am, also, of the opinion that the general statistics are subject to error for the following reasons:

First: None of these statistics taken from the operations of the most varied operators can be complete, as many operators do not publish their cases.

Second: Many operators only publish those cases which have a favorable result, and others only those which show some unusual characteristic.

Third: It is often impossible to report the later history of the patients.

Fourth: The various operators are not alike, either in the selection of cases or in the ability to operate.

Fifth: Some cases are reported twice.

Delavan properly requires the following of each statistic component:

First: The work performed must be of the highest order of perfection.

Section: All cases must be recorded in full, not only as to result but as to the details of the operation and of the after care.

Third: Sufficient time must elapse between the operation and the final report, in successful cases, to give full credit to the method employed.

These requirements can only be obtained from personal statistics of extensive "operators of the highest standing, who appear to have reported all of their material, good and bad." Delavan did me the honor to name me with Bergmann, Kocher, Mikulicz, Butlin, Schmiegelow, Fischer and Semon. He collected the results of these operators and calculated the percentage. These results are far more trustworthy than the

general statistics, even if the number of patients is not so numerous.

Finally, I have sought to classify and compare the purely personal statistics of capable operators. The general statistics, however, must not be discredited, inasmuch as they command a far larger number of cases than the other and as they give an incidental conclusion as to the progress in various periods.

The best general statistics were collected by Sendziak, of Warsaw, as he sent, in 1894, a circular to all surgeons and laryngologists in the International Centralblatt für Laryngologie, and the various surgical and laryngological journals, German, English and French, in order to study the cases operated upon, from the accounts of the operators themselves. In addition, he wrote personally to numerous operators. Three such general statistics have been published by Sendziak: one published in 1897 (Bergmann, Wiesbaden), which included all cases up to 1894, a supplementary one up to the end of 1897 (Nowiny lekarskie, 1899, Nos. 1 and 2), and, finally, in 1908, in abstract (*Monatsschrift für Ohrenheilkunde*, etc., No. 4.).

On account of the great care shown by Sendziak, these are the best statistics. He excluded all cases which were incomplete or observed too short a time. In addition, I desire to mention still another which I had made from the abstracts in Semon's Centralblatt, particularly from the beginning of 1895 to the end of 1908. All the objections previously mentioned are applicable to this which, however, will serve for comparison with Sendziak's statistics, to which it is inferior inasmuch as a direct correspondence with the individual operators was not possible on account of the lack of time.

The most important question in all of the statistics is, after what period one may consider a case of cancer of the larynx operated upon as definitely cured. According to Maydl, Scheier, Wassermann, Sendziak, and Delavan, this period should extend to three years. Semon thinks that a case remaining one year without recurrence is with highest probability, according to his experience, to be considered as cured. Still, I believe that the period should be held as three years, since even this is no absolute warrant of continued cure. Several cases have been reported in which the recurrence was much later. I wish to report several cases from my own practice.

A patient for whom Billroth, in 1889, removed the left vocal

band for cancer by thyrotomy, had no recurrence until four years later and from this he died three years later.

In 1900, I extirpated a vocal band by thyrotomy in a man who, six years later, died of cancer of the esophagus without involvement of the larynx. In October, 1903, I extirpated a cancerous vocal band in a patient who was affected again with cancer of the larynx in July, 1908. A patient died seven years after a unilateral extirpation of the larynx for cancer, from a new malignant neoplasm of the neck. As to the observation of others, I mention only the case of Hahn, which died from cancer of the cervical lymph nodes eight years after partial extirpation; and a case of Novaro in which death followed six years after operation on the cervical lymphatic nodes.

These cases show that there is really no positive foundation for the statistics; still, these cases are to be considered not as recurrence, but as newly occurring cancer in predisposed individuals.

On the other hand, there are favorable cases of cancer of the larynx which exhibit a benign course without radical operation. The case of Krieg and Knous is well known. I have reported several such cases. I wish, at this time, to speak more particularly of one (*Arch. für Laryngologie*, 1908). In February, 1888, I removed from the left vocal cord of a man who had suffered from hoarseness for two years, a soft, vascular papillary growth, which, according to the examination of Professor Paltauf, proved to be papilloma which was disposed to degenerate into cancer. The patient felt so well after the operation and had such a clear voice that he did not wish an external operation to be performed. I removed, by July, 1889, three recurrences from the same quite movable vocal band. The growth removed in July, 1889, was, according to Professor Paltauf's histologic examination, suspicious of carcinoma. The patient still refused operation. Tracheotomy was finally necessary, in October, 1892, after several additional intralaryngeal operations and total extirpation of the larynx was now advised. As the patient still persistently refused external operation, the disease continued to make further progress and he died in 1894.

In this case the carcinomatous growth was in spite of repeated intralaryngeal operations confined for two years to the vocal band and it did not interfere with the movement of the

band, a good proof that intralaryngeal operations are not so dangerous as considered by many.

I must now speak of the structure of carcinoma of the larynx, as this has certainly an influence on the rapidity of its growth. The most common form of cancer of the larynx is the squamous epithelium form, originating from the framework of the glottis. Horny, squamous, epithelial carcinoma or carcinoma karatodes is less common. Cylindrical epithelial cancer and medullary cancer are much less common, and fibrous carcinoma is the most infrequent form. The most favorable is the fibrous, which, however, is extremely uncommon. It grows very slowly and infects the nodes very late. Squamous cell carcinoma is fairly benign, particularly as it begins at the vocal bands. It affects the lymph nodes very late, while, on the contrary, the horny epithelial carcinoma and the medullary form grow very rapidly and infect the lymph nodes very early.

The conclusions drawn therefrom for the treatment of carcinoma of the larynx were published by Navratil (*Langenbeck's Archiv.*, 1905) in Buda-Pest. According to him, the common squamous cell carcinoma may be entirely removed by thyrotomy when it is intrinsic, and when it does not interfere with the mobility of vocal band. He advises partial extirpation in simple, intrinsic squamous cell carcinoma, involving only one-half of the larynx or the epiglottis, which has caused no metastases. He advises total extirpation in the beginning stages of horny squamous cell cancer and in squamous cell cancer which has extended, if the lymph nodes are felt small and not fixed.

Total extirpation is not indicated in extensive intrinsic cancer with participation of the esophagus and in horny squamous cell cancer, except when no metastatic lymph nodes are present, and, naturally, not in the very old.

In general, these indications of Navratil can only be approved, but it must be remarked that Gluck achieved good results with his method of operation even when there was extensive involvement of the pharynx, tongue, trachea, and thyroid, and in large lymph node tumors. At any rate, it would be desirable if in all cases the cancer had been determined by histologic examination before he had recourse to his radical operation.

As to the question of the province of the large external

operations for cancer of the larynx, it must be conceded to the experienced surgeon. This opinion is accepted everywhere. Among the American I mention John Mackenzie and Delavan. Naturally, the physician selected must have had experience in laryngology and there can be no doubt that this operation should, in the main, be undertaken by laryngologists who have had proper training as surgeons. It is self-understood that this claim can be made for but few laryngologists.

The operations which come into consideration for radical removal of cancer of the larynx are intralaryngeal extirpation, thyrotomy, partial and total extirpation of the larynx, and, in rare cases, subhyoid, transhyoid and lateral pharyngotomy.

#### INTRALARYNGEAL EXTRIPATION.

It is certainly indispensable, in most of the cases, to make a positive diagnosis. It is difficult, indeed, to recognize an intrinsic cancer in the beginning by laryngoscopy alone. Many laryngologists, and especially in America, Thrasher and Simpson in 1900, and Lincoln in 1903, have given expression to this view. It is, therefore, quite natural to remove a piece of the neoplasm intralaryngeally and to have it examined microscopically by a competent pathologist. This slight operation does the patient no harm. I need only mention Semon's report in 1887 and his address delivered in 1904 before the Laryngological Section of the Academy of Medicine in New York. John Mackenzie's fear, expressed in 1900, that the patient might be subjected to autoinfection is entirely erroneous. Mackenzie's position, "The removal of the piece for microscopic examination too often means the beginning of the end," is certainly incorrect. Many operators, including myself, have never seen such a result, and the case reported in this paper also shows this. Still, I do not wish to deny that any incomplete removal of a carcinoma may increase its growth.

Upon this point, Charles H. Knight made, in 1904, an interesting report. A growth on the vocal band, held to be a singer's node, was removed with the cold wire snare and recognized to be cancer; whereupon a rapid growth of the carcinoma resulted. Therefore, as I have long claimed, the external operation should not be postponed longer than a few days, or, at most, two weeks after the removal of the piece for examination, if the carcinoma has been determined histologically. In this way the simple intralaryngeal operation can certainly do no harm.

The case already mentioned, and several others, in which, on account of the refusal of the patient to submit to external operation, I was forced to perform intralaryngeal extirpation, have taught me that a radical cure can practically not be obtained by intralaryngeal operations.

Therefore, for more than twenty years I have held the opinion that as soon as any growth in the larynx has been determined to be cancer, it must be operated upon externally, if the operation is still admissible.

Still, attempts to remove cancer of the larynx by the intralaryngeal method have not been wanting, and occasionally with good result.

Elsberg, of New York, made the first observation of this sort in 1864. Recurrence followed and it was removed three years later by thyrotomy.

The first case treated with good result was reported by Schnitzler, of Vienna, who removed, in 1867, a tumor of the vocal band by the galvano-cautery method. Histologic examination showed it to be an epithelial cancer. This patient remained cured for twenty-two years.

*Indications.*—Most writers consider only small circumscribed tumors upon completely movable cords as proper for intralaryngeal method. B. Fränkel, alone, includes tumors which almost cover the vocal bands. Fränkel presents the following conditions in his article ("Die intralaryngeale Behandlung des Kehlkopfkrebs," *Arch. für Laryng.*, Vol. VI, 1897): "It must be possible to remove the entire diseased portion intralaryngeally, and one must penetrate into the healthy tissues. Even in thyrotomy, if this becomes necessary, no more should be removed than should be with the intralaryngeal method. The favorable time for external operation should never be sacrificed for an intralaryngeal operation." The patient must be under the continuous care of the physician.

B. Fränkel, Krieg, Jurasz and Bresgen report quite favorable results from this operation. B. Fränkel is especially an enthusiastic supporter. Krieg maintains, on the basis of his well-known case (*Arch. für Laryng.*, 1894), that favorable results may be obtained by this method in the uncircumscribed forms of carcinoma. It is further known that the enthusiastic advocates of this method—Fränkel, for instance—announce that recurrences are very common after intralaryngeal extirpation; as, for instance, the case of B. Fränkel where permanent cure followed only after four operations.

## RESULTS OF INTRALARYNGEAL OPERATIONS.

## General Statistics.

Author	No. of patients.	Relapses.	Cures.		Not available.
			Relative.	Absolute.	
Sendziak. To the end of 1894.	32	13 (40.7%) 4, 3, 2 years or earlier.	4 (12.5%) 2, 2, 2 and 1 years.	4 (12.5%) 22, 8, 5 and 3 years.	On account of insufficient observation, 11 cases.
Sendziak. To the end of 1897.	39	14 (39%)	5 (14%)	9 (25%)	11
Sendziak. 1888 to 1908.	39	13 (33%)	18 (46%)		8 insufficient observation.
Chiari. Beginning 1895 to end 1908.	36	8 (22.2%)	8 (22.2%)	8 (22.2%)	12 (33.3%)
			44.4%		

## THE NINE CASES OF B. FRAENKEL.

(Published in the Archiv. für Laryngologie, Bd. XI, 1897.)

Case.	Age.	Number and time of intralaryngeal operation.	Result.	Remarks.
I.	70	5—1881 to 1884.	Cured, 13 years.	Carcinoma cervical nodes operated 1884 by Madelung.
II.	57	1 operation.	Unknown.	
III.	67	2 operations; 1886, 1888.	Return in 1889, stenosis.	
IV.	49	1 operation, 1887.	Cured 10 years.	
V.	59	2 operations, 1888.	Cured 9 years.	
VI.	Old	1 incomplete.	Return. Thyrotomy healed.	
VII.	58	5 operations; 1888-1890.	Thyrotomy and extirpation of nodes in 1892.	
VIII.	66	2 operations, 1896.	Cured 1897. 1 $\frac{1}{4}$ years.	
IX.	Woman. 53	2 operations, 1890.	Cured 1897. 6 years.	

Among other authors than Sendziak there are only thirty cases, of which only twenty-two are of service, with twelve cures, in five of which the duration was only a half year, in three two years, and in four over three years, of which one was for twenty-two years and one for ten years.

It is clear, according to these statistics, that the intralaryngeal operation is entirely without danger. No instance of death resulted from the operation, forty-six per cent recovered, but in thirty-three per cent there was recurrence. If one observes correctly the indications of B. Fränkel, this does not render the chances of a later operation, especially thyrotomy, any worse. Still, the favorable cases are exceptional. For this reason most writers, such as Schrötter, Semon, Delavan and myself, declare the intralaryngeal operation insufficient. Nevertheless, Simpson reported a case, in 1900, a cure of four years' duration, and Ingals, in 1907, one of more than one year's standing.

#### TRACHEOTOMY.

Cannot be considered as a curative operation. It serves only to relieve the stenosis of the larynx caused by the cancer, or comes into play as a preliminary to the radical external operation.

#### THYROTOMY.

Was first undertaken in 1833 by Brauers, in Loewen, for polypi, and in 1844 by Ehrmann, in Strassburg, for carcinoma of the larynx. Ehrmann's case, however, is so imperfectly reported that it cannot be considered of worth. The honor of first properly reporting this operation for cancer of the larynx belongs to an American—Gordon Buck—who undertook it in the year 1855, before the invention of the laryngoscope. He noted, however, recurrence in five months, and the patient died in ten months.

Solis Cohen operated in 1868 and reported cure of twenty years' duration.

Paul Bruns (*Die Laryngotomie zur Entfernung endolaryngealer Neubildungen*, Hirschwald, Berlin, 1878), gives an extensive presentation of nineteen cases of thyrotomy performed up to that time for cancer of the larynx, with the exception of the cases of Buck and Solis Cohen. These nineteen operations were performed on fifteen cases, four being twice operated upon. In all cases, but one, there was recurrence, and this

patient died twenty-two months after the operation from cancer of the kidney, the larynx being free. Two patients died shortly after the operation. Besides these, there were sixteen local recurrences, in the main a few months after the operation. Bruns says in conclusion: "That the attempt at radical extirpation of cancer by means of thyrotomy has proved itself completely unsatisfactory and worthless." We should, however, not forget that wider-spread carcinoma had been operated upon after this method and that in five the operation had to be discontinued on account of hemorrhage.

This compilation made such an impression that in the following ten years thyrotomy was performed in but few cases.

At the London International Congress, in 1881, Foulis and Czerny formulated their views that established cancer of the larynx could only be relieved by total laryngectomy and then expressed almost no contraindications thereto.

Felix Semon stated, in the discussion at that time, that he presented no theoretic objection to total extirpation as such, but that he protested against its invariable use in all cases of cancer of the larynx, as this was neither theoretically or practically established. Semon further stated that we must see to it specially that a diagnosis of cancer is made early, so that we may get along with a smaller operation, a partial extirpation, or splitting the larynx alone, and removal of the soft parts. Semon has, since that time, striven to make the early diagnosis of cancer of the larynx possible, and has materially advanced it, especially in England. Butlin, who, since 1883, was of the opinion that total extirpation should be done immediately upon the establishment of the diagnosis, now attempts more often by thyrotomy to remove the soft parts alone or small portions of cartilage also, and is convinced, finally, of the radical value of this operation in proper cases—that is, early recognized and not too extensive cases, and especially in those limited to the vocal bands.

Semon soon followed his example and the favorable results of his operation, in the lessened number of deaths from the operation and in the greater number of definite cures, are the main reasons why thyrotomy, which formerly occupied such a bad reputation, has since then been used for the radical removal of cancer of the larynx.

*Indications.*—This operation is, according to the consensus of opinion of most operators, only indicated when the cancer is

small and circumscribed; when it involves the vocal or ventricular bands without prejudice to the motility of the vocal bands. If the arytenoid is immovable, it is an indication that the cancer has spread to the deeper portions. Even when the arytenoid is not swollen, a partial extirpation must be performed. Only Cisneros, at least up to 1905 (*Centralblatt für Laryng.*, 1905, p. 127), and Pieniazek (*Archiv. internat. de Laryng.*, etc., March and April, 1908), up to 1908, recommend thyrotomy in complete immovability of the vocal bands; and Pieniazek also in swelling of the arytenoid and large subglottic extension.

For this reason, these writers have such numerous recurrences, as we shall see later in our statistics. We must, therefore, agree with Semon that thyrotomy early enough undertaken in favorable cases is a truly ideal operation in cancer of the larynx. Even Gluck, who certainly does not shirk the most radical surgical operations, says: "Laryngofissure is not only a palliative measure in the early stages of carcinoma, but also a blissful radical and, therefore, conservative operation."

I need not speak extensively of the technic of this operation and the after-treatment, before this body of professional men. I will only mention that most operators perform tracheotomy first and then introduce a tampon-canula. Bruns (Tübingen), Moure (Bordeaux), and Pieniazek (Krakau) are content with a simple canula and permit the head to hang below. Pieniazek and his assistants have performed three hundred thyrotomies, twenty for cancer, in this way, without a death.

Butlin and Semon, who have reported very favorable results, and Moure remove the canula immediately after the operation and suture the larynx and trachea partially or completely.

The other operators, including myself, generally tampon the larynx with a Mikulicz tampon, then place an ordinary canula in and remove the tampon after three to eight days. Even Kocher, the celebrated surgeon, and most of the other operators, would not renounce this tampon, since it furnishes a positive protection against the entrance of blood, wound secretions, mucus, and saliva into the trachea during the first few days after the operation. One should not forget, in this connection, after splitting the larynx to apply cocaine to the inner surface of the larynx, according to the advice of Billroth, in 1886, and the warm recommendation of Felix Semon, or, according to

later practice, cocaine and adrenalin, which cause contraction of the blood vessels for three hours, but which, later, gives place to a strong relaxation of the vessel walls.

If the hemorrhage is ever so carefully stopped before closure of the larynx wound, as Butlin and Semon recommend, a secondary hemorrhage may very easily occur which the tampon prevents. Deglutition is also without danger if the larynx is tamponed. No special position is required of the patient under these circumstances, nor are nutrient enemata, whose value is quite doubtful, required to nourish the patient during the first few days. It is, however, true that immediate closure of the wound results in much more rapid healing, but I believe that the greater certainty against inspiration of blood, mucus, or food, after the operation, is of more value than a greater rapidity of wound-healing.

The operation is done by most operators under chloroform narcosis, especially if the anesthetic is to be administered through a tampon-canula. Chloroform narcosis has always been the rule with the Vienna school. Ether irritates the bronchial mucosa. The operation under local anesthesia is recommended, especially by Kocher and Bruns. I have tried it several times, and Edmund Meyer recommended it at the International Congress of Laryngo-Rhinology in Vienna, in 1908. Some patients refuse to be operated upon under local anesthesia, and I must state that, according to my experience, local anesthesia only occasionally produces painlessness, while many patients complain of very severe pain.

## GENERAL STATISTICS OF THYROTOMY.

Author	No. of patients.	Deaths following operation.	Returns.	Insufficient observation.	Cures.		Notes.
					Relative, over 1 year.	Absolute, 3 years.	
Sendziak, 1897. 1851—1894. These 92 thyrotomies were performed on only 85 patients.	85	9 (9.8%)	49 (53.3%)	8 (8.7%)	12 (13%)	8 (8.7%)	Total number 86.
Sendziak, Nowiny Lekarsky, 1899. From 1851 to end 1897.	136	12 (8.8%)	78 (57.3%)	16	17 (12.5%)	17 (12.5%)	Total number 140.
Sendziak, 1908. From 1888 to end 1907.	214	5 (2.4%)	46 (21.5%)			106 (50%)	Total number 157.
Chiari. Beginning 1895 to end 1908.	99	5 (5%)	19 (19%)	23 (23.3%)	33 (33.3%)	19 (19.1%)	
						52.4%	

## RESULTS FROM THYROTOMY.

Comparison of these statistics teaches that thyrotomy has given more favorable results during more recent times. Since 1888, cure has resulted in fifty per cent of the cases; since 1894, in fifty-two per cent. On the other hand, the percentage between 1851 and 1894 was only twenty-two. Schmiegelow (*Annales des Mal. de l'Or.*, April, 1897) presented the statistics of forty-nine cases, from 1890 to 1896, in which there was recovery in fifty-six per cent of the cases. A fatal issue was uncommon—from 2.4 to 9.8 per cent; and recurrences appeared since 1888 in 20 per cent of the cases, and since 1894 in 19.1 per cent.

Delavan (l. c.) collected, in 1900, the results of seven operators who reported a relatively large number of thyrotomies and who published all their cases in great detail. These operators were Bergmann, Kocher, Mikulicz, Butlin, Semon, Chiari and Schmiegelow.

## DELVAN'S STATISTICS OF SEVEN OPERATORS. RESULT OF THYROTOMY.

No. of cases.	Deaths from operation.	Recurrences	Relative recovery.	Definite recovery.	Total.
50	9 18%	9 18%	23 46% 70%	12 24%	53

## PERSONAL STATISTICS OF THYROTOMY.

Operator.	No. of patients.	Deaths following operation.	Relapses	Cures.		Too short observation.
				Relative.	Definite.	
Billroth; Langenbeck's Archiv. 39 Bd. (Salzer), in 18 years, 1870-1888	10	3 (30%)	4 (40%)	3 (30%)		
Semon, 1886-1896. Fränkel's Archiv. 1897.	8	2 (25%)	1 (12.5%)	4 (50%)	1 (12.5%)	
				5 (62.5%)		
Butlin*	14	2 (14.3%)	6 (43%)	3	3	
				43%		
Semon, 1891-1904	20	1 (5%)	2 (10%)	17 (85%)		
Chiari	41	3 (7.32%)	11 (27%)	4 (9.75%)	11 (27%)	12 (29.2%)
				(36.75%)		
Cisneros; Trans. I Int. Laryngo - Rhinological Congress, Vienna, 1908.	13		12 (92.3%)		1 (7.7%)	
Pianiazek; Archiv. int. de Laryngologie, Mar-Apr. 1908	18		10 (55.5%)	1 (5.5%)	5 (27.8%)	2 (11.1%)
				(33 1-3%)		
Koschier	8			5 (87.5%)	3 (12.5%)	

\*According to Sendziak up to 1894.

My personal statistics deal with forty-six cases of thyrotomy for cancer of the vocal bands, from 1894 to the end of 1907. The diagnosis was established in each instance by histologic examination of a piece removed for that purpose. The operation was done in one stage or in two stages; that is, by preceding the operation with a tracheotomy four to eight days before. Of the twenty-three clinic cases, four were performed by a former assistant, Dr. Harmer, now professor at Prague, and two by Dr. Kahler, my present assistant at the University. Five cases I deemed valueless for statistical purposes, inasmuch as it was found, at the time of performing the laryngofissure, that the neoplasms had perforated the thyroid. On account of the poor prospect for total extirpation, I did not perform complete laryngectomy. There remained only forty-one cases to report. One case was very interesting in that there had been no recurrence, but cancer of the esophagus appeared in the sixth year, while the larynx remained clear. In another case there was, after four and a half years, a recurrence in the larynx on account of which I removed almost the entire larynx. These two cases are included under the recurrences. In a third case, I was compelled to perform total laryngectomy after a year and a half, and the patient succumbed two years later from carcinoma of the lymph nodes. In a fourth case, on account of a recurrence, a partial laryngectomy was performed by Eiselsberg, with good results.

I had no deaths to record up to 1904 among the nineteen cases in which this operation was performed. The three deaths occurred between 1904 and 1907, in two instances due to fatty heart, and in one to a secondary hemorrhage of the thyroid vessels. End results of the eleven definitely healed cases: nine still live, from three to nine years, and two died in four and seven years from an intercurrent non-cancerous affection.

I received a personal communication from Dr. Koschier, relative to the data of his cases of laryngofissure for cancer.

From these personal statistics it appears that the results are exceedingly variant. The percentage of death is from 0 to 25, of recurrences from 0 to 92, and of cure from 7.7 to 87. A number of personal statistics include so few cases that their value is slight. But, at any rate, Semon had the best results with his twenty cases, from 1891 to 1904, if Koschier's eight cases are excluded on account of the limited number.

My own statistics, of forty-one completed operations, show about the average results, and, by reason of the relatively large number of cases, they give a most reliable estimate of the value of thyrotomy. The number of cures would have been much greater if there had not been thirty-nine per cent of my cases (i. e., twelve cases) without later news. These refer mainly to patients from foreign countries, the Balkan Peninsula, Russia, and to those belonging to the poorer classes whose addresses were unknown.

Very likely some of these twelve cases belong to the group of those recovered, as they had been dismissed, cured.

The bad results of Cisneros are to be explained on the basis that he included among the thyrotomies, up to 1905, every case in which the vocal band was partially or completely immovable; i. e., such cases as properly belong to unilateral laryngectomy.

The same thing pertains to Pieniazek who, likewise, established too broad indications for thyrotomy.

All operators report that the voice always becomes good after the removal of one vocal band, and also after removal of the ventricular bands. One of my patients delivered scientific lectures for a year after the operation, and one in whom I had removed both vocal and ventricular bands in three thyrotomies can still, after seven years, speak quite loud and can be understood. In none of my patients was it necessary to reinsert the canula. For these reasons, thyrotomy is an operation full of blessing in suitable cases. It has very slight mortality and exhibits many lasting cures. The important factor in producing a favorable result is the early diagnosis of the cancer.

#### PARTIAL EXTRIPATION.

Under this head are included the atypical partial extirpation and the typical unilateral form, as well. Heine, in Prague in 1874, first introduced partial extirpation for the relief of cicatricial stenosis. The first surgeon to use it for cancer of the larynx was Maas, of Breslau, in 1876, who removed all the larynx except a piece of the cricoid and the epiglottis. Recurrence appeared in three months.

Billroth, of Vienna, who first undertook this operation in 1878, removed the whole left half of the larynx, and he gave it the name of "halbseitige extirpation." According to Sendziak, this operation was performed in 224 cases of cancer of the larynx up to the end of the year 1907.

*Indications.*—The most suitable cases are those in which the cancer is developed upon the vocal bands and visibly retards or prevents their mobility, without the presence of lymph node enlargement and without the pharynx being affected.

Somewhat less suitable are the extrinsic cancers which have their origin on the arytenoid or the aryepiglottic folds, and, finally, those cases in which one side of the larynx is wholly involved. If the other side becomes eventually involved, it is always possible to remove smaller or larger portions of the affected part, but the result of the operation is always more doubtful. It depends, therefore, on the opinion of the operator, whether he attaches importance to the fact that a small portion of the larynx is left in relation with the trachea, by means of which voice production is greatly facilitated.

As a usual thing, tracheotomy is generally performed five to fourteen days before the partial extirpation. This is quite necessary if severe dyspnea is present, in order that the patient may be relieved of the results of larynx stenosis. If no dyspnea is present, the tracheotomy may be performed immediately before the extirpation.

The operation is practically always performed with the aid of a tampon canula, under chloroform narcosis. Kocher, of Berne, performed, under cocaine, such partial extirpations in which it was not necessary to remove so much of the cartilage.

I do not wish, at this place, to go into the details of the operation. The cricoid may be spared occasionally in partial extirpation. Under these circumstances, naturally, the operation is easier. If, on the contrary, a piece is taken away from another level of the larynx, the operation will be longer and more detailed, but the course will be the same. I have often, in such cases, removed almost the entire larynx in this way, but of late I perform total resection with previous suture of the tracheal stump, after the method of Gluck.

If the pharynx is involved, the affected portion must be cut away and removed from the healthy portion. In this particular, all suspicious lymph nodes are included.

*After-Treatment.*—The first tampon, which is introduced with special care, is permitted to remain as long as possible, as Koschier recommends. When the tampon no longer completely closes, in about eight days, it is replaced by another and this is changed as often as necessary. After five or six days the nourishment tube may be removed, as the patient can

by that time swallow somewhat, and the granulation formation of the wound is fairly effected. In eight days the patients learn to swallow well, especially semisolid food, while liquids must often be introduced for a longer time through the esophageal tube, introduced for that purpose. Deglutition becomes particularly easy when the severed mucosa of the posterior wall of the larynx has united to the neighborhood of the tongue. Healing occurs through granulation.

The opened portion of the vertical skin wound closes also by granulation, which may be assisted by approximation of the wound with strips of plaster.

Upon eating, it is necessary for some time to prevent the passage of food into the trachea by pressure of a tampon on the side operated upon.

The duration of the healing until the patient swallows without danger depends upon the extent of the wound and the strength of the patient—from three to six weeks.

The final result is quite good, especially when the cricoid can be retained. Then it is generally possible to remove the canula permanently in five to six weeks. If the cricoid has been removed, the lumen of the larynx is so greatly stenosed by the intrusion of the soft parts on the operated side that the canula must be retained. Often the canula may be worn closed during the day, but must be used at night for respiration.

Natural speech becomes generally good as a fold of the pharynx lies alongside of the healthy vocal band, and thus forms an artificial glottis. Even when both vocal bands are removed, a fairly intelligible speech may obtain, as there may be anywhere in the pharynx a narrow place by which the remaining muscles may produce speech.

The most serious dangers from the operation are shock, sepsis, and, finally, aspiration pneumonia. In order to obviate aspiration pneumonia, Gluck recommended a laryngoplastic at the International Laryngo-Rhinological Congress, at Vienna, in 1908. (See proceedings, pages 70 and 71.) He forms an organic living diaphragm, thus: "By making a rectangular skin flap on the affected side in advance and implanting this flap upon the resulting defect after extirpation of half of the larynx and suture of the pharynx. This skin flap ought later, in some measure, to replace the half of the larynx. The flap is definitely fixed with sutures upon the remaining portion of

the healthy larynx, which is closed from secretion by tamponade and tampon suture. In this way a complete closure of the respiratory tract from the wound is attained." This method seems at least worthy of imitation.

## THE RESULTS OF PARTIAL LARYNGECTOMY.

## GENERAL STATISTICS OF PARTIAL LARYNGECTOMY.

Author	No. of patients.	Deaths following operation.	Recurrences	Cures.		Notes.
				Relative.	Definite.	
Sendziak, 1897; 1876 to end of 1894.....	110	29 (26.3%)	31 (28.2%)	13 (11.8%)	12 (10.9%)	21 Insufficiently observed. Total, 106.
Sendziak, 1899; Nov. Lekarskie, 1876 to beginning 1898.....	201	44 (21.8%)	63 (31.3%)	20 (10%)	26 (12.9%)	27 Insufficiently observed, 27. Unknown, 21.
Sendziak, 1876 to beginning 1908, 224 cases; 171 since 1888.	171	29 (17%)	52 (30%)	39 (22.8%)		51 Unknown, 51
Chiari, 1895 to end 1908.	141	20 (14.8%)	22 (15.6%)	11 (7.8%)	39 (27.7%)	49 Insufficiently observed, 49. (34.7%).

As an example of national statistics, I wish to make mention of the report of Professor Perez relative to Italian operators. (\*)

Perez collected 104 cases of extirpation of the larynx by Italian operators, of which only 13 were partial laryngectomy. It appears, therefore, that the Italian surgeons are unusually devoted to total extirpation.

\*Atti della clinica oto-rinolaringo-latrica della R. Università di Roma, Anno IV, 1906; Tipografia di G. d'Antonis. Risultati statistici delle laringectomie praticate in Italia.

## ITALIAN STATISTICS.

Writer.	No. of patients.	Death following operation.	Recurrence.	Cure.	
				Relative.	Definite.
Perez, to 1906.....	13	3 (15.3%)	5 (38.4%)	4 (30.6%)	2 (15.3%) 45.9%

Cure resulted in these few, very favorable cases in 46% of the cases. The large general statistics show a decided reduction in the fatal cases and recurrences, and an increase in the cures after 1888 and especially after 1895. Delavan's statistics, which were collected from the reports of seven operators (by the before mentioned and by Fischer), show the transition to the purely personal statistics.\*

Of the 32 partial laryngectomies reported by me, two each were performed by my assistants, Professor Harmer, Dr. Kahler, and Dr. Marschik, at the clinic during vacation, the remaining 26 by myself. One case remained cured for six years, when I lost sight of him. Another died six years and four months after operation from carcinoma of the neck, which appeared three months before death. I have included this case under the recurrences. Two of the eight relatively cured patients have lived for two years and four months, and two years and two months, up to the present time, two lived two years and eight months and two years, and one lived eight months and then disappeared from observation. One died of pneumonia one year after operation, one died of diabetes one year after operation, and one died one year and two months after operation from a febrile disease of two days' duration, all without recurrences.

There was recurrence in fifteen cases; in four after one year, in one after six years and four months, and in ten after a few months. I removed almost the entire larynx in some of these cases.

\*See next page.

## DELAVALAN'S STATISTICS.

Author	No. of patients.	Deaths following operation.	Cures.		Remarks.
			Relative	Definite.	
Delavalan, 1900. Results of 8 operators.....	56	15 (26.8%)	21 (39%)	34 (56%) 27 (43.5%)	7 (12.5%)

## PERSONAL STATISTICS.

Billroth, 18 years (cited by Salzer).....	14	5 (35.7%)	6 (42.8%)	3 (21.4%)	
Bergmann; Graf-Deutscher Laryngologen Kongress, 1897.....	20		8 (40%)		
Cisneros, 1908.....	40			6 (15%)	
Koschier, 1909.....	16	1 (6.25%)	10 (62.5%)	3 (18.75%)	2 (12.5%) Insufficiently observed; operated in 1906, 1907, 1908.
Gluck, 1908.....					States that he performed hemilaryngectomy 43 times without a death since he has been making his laryngoplastie. In 13 of these cases there was a recurrence; 19 showed no recurrence.
Chiari, to end 1907.....	32	8 (25%)	15 (46.67%)	8 (25%)	1 (3.1%) (28.1%)

The personal statistics show most varying results; the percentage of fatal cases in Koschier's cases was only 6.25, while he had 62 per cent recurrences; the results of the other operators were much more nearly uniform. An exceptional result is to be found in the report of Gluck who had no fatal issue following the 42 hemilaryngectomies which he performed according to his method. However, he does not present a statistical account of his cases.

#### TOTAL EXTRIPATION.

Watson, of Edinburgh, extirpated the whole larynx for syphilis, in 1866. Czerny, while assistant of Billroth, in Vienna, removed the entire larynx in dogs and showed that they were in moderately good condition afterwards. By reason for this, Billroth made the first operation in man for cancer on December 31st, 1873. The patient died, however, eight months later from a recurrence, which very likely arose from the epiglottis which was not removed. Since this time, the operation has been frequently performed. Sendziak was able to report 188 such operations up to 1894, and more than 416 up to the end of 1907.

*Indications.*—The opinion of specialists has been changed to the effect that total larynx extirpation, or laryngectomy as it is also called, is only necessary when both sides of the larynx are affected. In general, we can say that very many operators consider those cases only as operable where there are not many lymph nodes affected and these completely movable. Besides, not a great portion of the pharynx must be affected with cancer, and but few of the rings of the trachea or the thyroid gland. Many operators believe that those cases of intrinsic cancer which grow through the thyroid cartilage and extend outwardly can hardly give any hope of radical cure. Most operators operate, with a tampon canula, several weeks after a preliminary tracheotomy. Only a few apply a single canula and endeavor by the position of the patient, with head hanging down, to prevent the entrance of blood into the trachea.

Bardenheuer, in 1890, made the proposition that the mucosa of the posterior wall of the larynx,—that is, the anterior wall of the esophagus,—be sutured to the mucosa of the pharynx in the neighborhood of the hyoid, thus completely closing off the oral cavity from the wound remain-

ing after the removal of the larynx. Bardenheuer also advised that the patient should lie in bed in such a way that the head would be much lower than the tracheal opening so that the discharges from the mouth could not flow into the trachea. Butlin and Semon place the patient horizontally on the side (in the unilateral extirpation on the operated side). The after-treatment is the same as in partial extirpation. I have lately heard of the excellent results of Dr. Chevalier Jackson, who had, I believe, no deaths and numerous cures.

The completed operation leaves, as a rule, a connection between the wound opening and the trachea, so that the patient, even if he wears the canula, can blow air through the window of the canula into the pharynx and oral cavity. In order to give the patient vocal speech, a tube may be introduced, in three or four weeks, from the canula to the lower end of the pharynx and a reed may be placed in this tube. This instrument is known under the name of artificial larynx. This artificial larynx, however, generally gives the patient such discomfort and annoyance that he remains content with whisper voice. This whisper voice, as a rule, becomes fairly satisfactory by exercises and the artificial larynx is discarded.

That it is possible to have a fairly loud voice after complete closure of the pharynx and oral cavity from the trachea was already known to Czermak, and was later often confirmed by Gluck.

#### GLUCK'S OPERATION METHOD.

In order to obviate the danger of aspiration pneumonia and an infection of the neighborhood of the wound through blood, discharge or food, Gluck recommended a procedure at the Surgical Congress in Berlin in 1881, with the report of several favorable cases, by which the trachea is cut off from the larynx one to two weeks before the operation, drawn forward and sutured as carefully as possible with its borders in the skin wound. This prophylactic suturing of the tracheal stump forms an absolute protection against the development of aspiration pneumonia. More recently, he releases the entire larynx and upper part of the trachea from their attachments and then severs the larynx from the trachea and sutures the tracheal stump.

He uses the old method only where there is serious

dyspnea. Gluck reported in 1908 that he had a cure in 128 of his own cases of total laryngectomy. None of his cases of typical laryngectomy in many years has succumbed to the operation. Out of about 300 operations on the upper respiratory and deglutition apparatus in which it was necessary to make very extensive extirpation of lymph nodes, ligatures of the large cervical vessels and extensive resection of portions of the tongue, pharynx and esophagus, the mortality reached only 13 per cent. Already in 1904 he could present a series of eleven such serious cases without fatal issue from the operation. It is unfortunate that up to the present time there are no definite personal statistics of Gluck's operations for cancer of the larynx. However, it appears from the data just mentioned that his results are better than those of any other operator. For this reason I use as often as possible his method of suturing the trachea in advance and shutting off the pharynx from the trachea and the adjacent tissues; so far I am satisfied with this method.

Of my nine cases,\* eight were performed by me and one by my assistant, Dr. Kahler, in the clinic. In eight of the cases the tracheotomy was performed several weeks in advance. In my last case, it was necessary on account of severe dyspnea to open the trachea immediately before the extirpation.

Gluck's method was used in all the cases, for the trachea was sutured into the skin wound and the pharynx completely shut off below from the respiratory tract.

In general it must be said that the personal statistics are in part incomplete and in part the cases are too few to permit any definite conclusions to be drawn from them. The general statistics, which show very favorable results only remain to determine the value of complete laryngectomy. So far as mortality is concerned, the results since 1895 are better than in partial laryngectomy and are next to thyrotomy; it surpasses all other methods in regard to recurrence; as to cure, it ranks just next to partial laryngectomy and about half that of thyrotomy. Gluck's results, as already mentioned, are the best. It is true that he has had a mortality in all of his complete laryngectomies of 13 per cent, while my general statistics from 1895 to 1908 show only 12 per cent, but he had many seriously complicated

\*See page 29.

GENERAL STATISTICS OF RESULTS OF TOTAL EXTRIPATION.

Author	No. of patients.	Deaths following operation.	Returns.	Cures.		Remarks.
				Relative.	Definite.	
Sendziak, 1873-1894 incl.	188	84* (44.7%)	61 (31.45%)	13 (6.9%)	11 (5.85%)	24 cases insufficiently observed. Total, 193.
Sendziak, to 1897 incl....	267	94 (35.2%)	81 (30.3%)	24 (9%)	12 (4.4%)	32 cases insufficiently observed. Total, 243.
Sendziak, 1873 - 1907 (416); 1888 to end 1907 (269),.....	269	58 (21.6%)	46 (17%)	58 (21.6%)	58 (21.6%)	107 cases insufficiently observed.
Perez, 1906 (Italian operators) .....	73 for carcinoma laryngis.	22 (30.13%)	29 (39.8%)	5 10 (12.7%)	5 10 (12.7%)	Deaths from intercurrent diseases, 6 (8.2%); insufficiently observed, 6 (8.2%).
Chiari, 1895 to end 1908 (including 24 complic- ated cases.)	242	29 (12%)	21 (8.7%)	24 (9.9%)	38 (15.7%)	130 cases insufficiently observed (53.7%).
					25.6%	

From these General Statistics it will be seen that the results are distinctly better since 1888, especially since 1895. Especially noteworthy is the decrease of deaths following the operation to 12 per cent and that of returns to 8.7 per cent.

DELAVAN'S STATISTICS (1900) OF SIX OPERATORS.  
(Bergmann, Kocher, Mikulicz, Fischer, Chiari, Schmiegelow.)

Author	No. of patients.	Deaths following operation.	Recurrences	Cures.		Insufficient observation.
				Relative.	Definite.	
Delavan .....	34	9 (26.5%)	12 (35.3%)	11 (32.3%)	2 (6%)	Death from intercurrent diseases 16 (47%),
AUTHOR'S STATISTICS.						
Billroth, 18 years (according to Salzer) .....	6	4	1			
Bergmann, 1883-1896 .....	28				4 (14.3%)	
Cisneros, 1908 .....	15					
Koschier (personal communication) .....	3				2 (66.6%)	Insufficiently observed, 1 case.
Gluck, 1908 .....	128		In uncomplicated cases practically none.		35% 25   20	
Chiari (to 1909 incl.) .....	9			4 (44.4%)		Two observed only a few months (22.2%).

cases with involvement of the tongue, esophagus, thyroid gland and ligature of the large vessels. In the uncomplicated cases he had no mortality, so the superiority of his method is demonstrated. Cisneros had in one year 7 complete laryngectomies with suture of the trachea in advance, death following in only one case (*Boletin de laringologia*, Dec., 1907). v. Hacker (Graz) and Motella (Madrid) also operate according to Gluck's method. Patients upon whom Gluck's method of total laryngectomy has been performed learn almost always easily understood pharyngeal speech which is often loud in character. This result is attained more quickly by instruction from a specialist in speech defects.

Deglutition is difficult in those cases only in which a large part of the pharynx or esophagus has been removed. In such cases Gluck uses rubber prosthetic appliances which carry the food through the mouth. I saw such patients in London in 1905, and in Vienna in 1908, in which Gluck had removed, at the same time, the larynx, some tracheal rings and a portion of the tongue and esophagus. They wore a prosthetic appliance, were well nourished, spoke with a loud voice in spite of a large cervical fistula. They declared that they were satisfied with their lot. It is certain that this extensive resection of the larynx, pharynx, esophagus and tongue is justifiable from an ethical and social standpoint. Therefore, we must be thankful to Gluck for his tireless and oft misunderstood efforts. In spite of this it must be the endeavor of the laryngologist to recognize cancer of the larynx so early that it may be radically cured by thyrotomy, as this operation results in the most cures and but slight mortality even if there are more recurrences than in complete laryngectomy. Those operated upon breathe, speak and swallow in the natural way; but these results are attained only if Semon's advice is followed, namely, to perform thyrotomy only if the intrinsic cancer but slightly diminishes the motility of the cords. Early diagnosis, however, is only possible after intralaryngeal removal of a portion of the growth for diagnostic purposes—an operation which is not difficult.

I must therefore declare that the opinion of John MacKenzie, against the extirpation of a portion of the growth for microscopic diagnosis and against thyrotomy as a radi-

cal operation, as unfounded in view of the experience of many distinguished laryngologists as well as my own.

Only with insufficiency of thyrotomy is partial or complete laryngectomy advisable.

#### UNCOMMON OPERATIVE PROCEDURES.

Subhyoid pharyngotomy (Richet), or subhyoid laryngectomy (Malgaigne), is proper for those cancers which involve only the entrance of the larynx; they are generally located on the epiglottis alone, more uncommonly on the arytenoid or aryepiglottic fold.

The following gives the results.

#### GENERAL STATISTICS.

Writer.	No. of patients.	Mortality.	Cure.		Too short observation.
			Relative.	Definite.	
Sendziak up to the end of 1894 .....	8	5 (62.5%)	1 (12.5%)	1 (12.5%)	1 (12.5%)

Cisneros reported in 1908 two cases without special details. The operation gave very unpleasant immediate results. Semon (*Fraenkel's Archiv.*, Vol. VI, p. 412) operated a single time, the patient dying in four days. I did it once in 1897, in connection with a lateral pharyngotomy for a cancer of the right arytenoid and of the recessus piriformis. The patient recovered, but had a recurrence in the lymph nodes at the end of that year.

Rene Lacour\* collected 40 cases operated on for various conditions, with a mortality of 10 (25 per cent). It is seldom done for carcinoma of the larynx. Cisneros, epithelial carcinoma of the epiglottis, recovery (*Centralblatt für Laryngol.*, 1900); Lutz, epithelioma of the larynx, recovery (*Philadelphia Med. Journal*, February 24, 1900); Lambert Lack, epithelioma of the larynx, recovery for over two years (*Centralblatt f. Laryng.*, 1906, p. 36); Brockaert (*Centralblatt fuer Laryng.*, 1905, p. 352). Subhyoid pharyngotomy with temporary resection of the hyoid bone for tumor of the ary-

\*These de Paris, 1897. *Central. f. Laryng.*, 1898, p. 315.

tenoid and pharynx, death in three weeks. Also, since 1895, six operations with two deaths, one recurrence and three recoveries.

TRANSHYOID PHARYNGOTOMY was introduced by Vallas, 1896. It comprehends the median splitting of the hyoid bone and membrana hyoidea, permitting the edges of the wound to be held apart by strong retractors. It is claimed that in this way the passage to the larynx is good. Cisneros stated in his report at the International Congress of Laryngo-Rhinology at Vienna that he had performed the operation eight times but did not mention his results.

MEDIAN PHARYNGOTOMY by Mouret (*Bulletins et Memoires de la Societe Franc. de Laryn. et de Rhin.*, 1908, p. 405), is a combination of transhyoid pharyngotomy and thyrotomy. It has not been used for cancer up to the present time.

LATERAL PHARYNGOTOMY has been used according to various methods, those of Langenbeck, Bergmann, Küster, Mikulicz and Cheever, and is suitable especially for carcinoma of the pharynx and tongue and less so for cancer of the larynx. I once saw Gussenbauer remove a cancer of the left arytenoid after this method; the patient however died of diabetes ten days afterwards. Lambert Lack (Proceedings of the London Laryngological Association, March 17, 1905; *Centralblatt fuer Laryng.*, 1906), removed a carcinoma of the right arytenoid and pharynx, after this method. Recovery for one year.

I repeat, in conclusion, that in such a terrible disease as cancer of the larynx, serious undertakings are permitted but the patient should be fully informed of his disease with the greatest indulgence. The results of the individual operation can be only properly determined if all extensive operators report all their cases with the utmost detail as was already suggested by your distinguished colleague, Bryson Delavan in 1900.

## XXI.

### A STUDY OF THE ANATOMIC RELATIONS OF THE OPTIC NERVE TO THE ACCESSORY CAVITIES OF THE NOSE.\*

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Although a great deal has been written during the past ten or fifteen years upon the anatomy of the accessory cavities of the nose, comparatively little has been done in the direction of establishing the relation which they bear to the optic nerve. True, the exhaustive work of Onodi<sup>29</sup> has been of great value in this respect, but there is still much to be done.

#### CLINICAL REVIEW.

There has been considerable clinical evidence of this relation, as may be easily discovered by a casual view of the literature. In this abstract of cases I have purposely excluded the large number of orbital abscesses which have been reported, confining it to those in which changes in the nerve itself were noted, without symptoms of an associated infection of the periorbita.

Berger and Tyrman<sup>2</sup> state that 26 cases of blindness had been reported, due to disease of the sphenoid, six from caries and twenty from tumors.

Welge, according to Berger and Tyrman,<sup>2</sup> reports the case of a man who as a result of suppuration in the accessory cavities of the nose became blind in both eyes.

Caldwell<sup>6</sup> reports a case of suppuration of the sphenoid sinus and marked hyperemia of the disk with necrosing and

\*Read before the New York Academy of Medicine, November 25, 1908.

cystic ethmoiditis, causing atrophy of the right and then the left optic nerve and blindness.

Kuhnt<sup>9</sup> cites a case of amaurotic amblyopia following an acute coryza.

Courtaix<sup>8</sup> collects several cases of ocular disease from literature which seem to be due to suppuration of the maxillary sinus: B. Travers.<sup>43</sup> A case of beginning amaurosis, checked by extraction of a tooth. Galezowski.<sup>9</sup> Amaurosis, cured after thirteen months by extraction of a tooth. Pasquier.<sup>43</sup> Five days after extraction of a tooth, sudden complete right-sided amaurosis developed with foul discharge from the nose. Ten days later sight returned. Joh. Hjort<sup>10</sup> reports a case of frontal empyema causing exophthalmus and papillitis with distinct diminution of vision.

Winckler<sup>45</sup> reports a case of retrobulbar neuritis cured by removal of a hypertrophied inferior turbinate.

Hansell<sup>11</sup> reports a case of acute loss of vision, due to disease of the ethmoid and sphenoid cavities.

Holmes<sup>12</sup> gives the notes of a case of empyema of the left sphenoid sinus which had been unrecognized until patient completely lost sight in the left eye. Vision became normal after opening the sphenoid sinus.

Bull<sup>4</sup> calls attention to symptoms from involvement of the optic nerve by tumors of the sphenoid.

De Lapersonne<sup>20</sup> reported at the Congress at Utrecht several cases of unilateral optic neuritis with greyish projecting papilla, with voluminous and tortuous vessels hidden by edema behind the papilla, without retinal hemorrhages. They were accompanied by well-marked amblyopia, scotoma and reduction of the visual field. In spite of treatment, they resulted in complete blindness of the affected side through papillary atrophy. Careful rhinoscopic examination revealed sphenoid sinusitis or posterior purulent rhinopharyngitis. In the discussion which followed, these observations were confirmed by Knapp, Meyer, Kuhnt and Gutmann; Meyer claiming that the attack could be arrested by treatment of the sinus disease.

Halstead<sup>14</sup> observed sudden blindness in the left eye in a case of empyema of the right maxillary, ethmoid and sphenoid cavities. After operation the patient recovered vision. He thought that the contralateral involvement depended upon the rupture of the sphenoid septum, but in the light of later

studies of the relation of the sphenoid cavity to the optic nerve, a better explanation is found in the fact that a sphenoid sinus may be in relation with both optic nerves. (See figures 1, 7, 9, 10, 13, 14, 15, 16, 22, 24, 25, 28, 29, 30.)

Mendel<sup>25</sup> reported several cases in point:

(a) A patient with left exophthalmus for two years with gradual loss of sight, whole lower and part of temporal portion of the left field of vision lost; disk outlines indistinct and pale; pus found in left antrum. Operation resulted in some improvement in vision.

(b) Sudden loss of sight in left eye with large absolute central scotoma and suppuration of anterior and middle ethmoid cavities. Operation was followed by immediate improvement, eventually with almost complete recovery of sight.

(c) In (four of seven) cases of unilateral optic neuritis, the accessory cavities were involved in (four) cases, one being of the maxillary. An old amaurosis was not cured by operation, nor was a case of bilateral atrophy.

Nordquist<sup>27</sup> reports a case of optic neuritis, due to maxillary empyema.

Broeckaert<sup>8</sup> reports the case of a woman suffering from chronic suppuration of the ethmoid and frontal with detachment of the retina and numerous opacities of the vitreous. The opacities disappeared, the detachment persisted and vision became sharp in the intact portion of the retina after the suppuration was relieved.

De Lapersonne,<sup>21</sup> in a most detailed paper, discusses the various aspects of the subject. He calls attention to the reports of Reinhardt, Braun, Neiden and Panas, who had noted blindness, unilateral or bilateral, following infectious optic neuritis, but in these the lesions were very extensive. He maintains that sphenoid sinusitis may be complicated by optic neuritis, papillitis with more or less encroachment on the retina, and prepapillary edema, accompanied by considerable diminution of central or peripheric vision; and that while amelioration is possible by treatment, the prognosis is none the less serious.

Risley<sup>29</sup> describes a case of hemicrania and partial loss of sight, which were relieved by treatment of a gummi of the maxillary sinus; another case of general neuritis with blindness in maxillary empyema; and another in which a second-

ary neuritis from sphenoid and ethmoid empyema resulted in blindness of the right side.

Gronbak<sup>18</sup> had a patient, aet. fifty-one years, who was referred to him by an ophthalmologist with the statement that there was disease of the left optic nerve and several motor branches of the ocular muscles, complete amaurosis on this side, nothing on ophthalmoscopic examination, papilla normal, distinct exophthalmus. Upon removal of the nasal polypi and a large carious portion of the left middle turbinate, he found for the first time thick, foul-smelling pus coming from the ethmoid cells. The carious portions of the ethmoid were removed and the opening of the sphenoid sinus enlarged. The exophthalmus disappeared, the muscular paralysis vanished, but the amaurosis continued unchanged.

Polyak<sup>19</sup> reports a case of bilateral optic atrophy of three years' standing, resulting from a suppurating bone cyst of the left middle turbinate, which filled the left nostril and closed the openings of the posterior ethmoid and sphenoid, causing retention of secretions and eventually empyema of these sinuses. As there was no other way for it to grow, Polyak thought that it forced the posterior portion of the septum to the extreme right, causing retention of secretion and empyema on this side. Although the process started on the left side, the right optic became first affected. It is, however, no less rational to assume that the left sphenoid was in relation with both optic nerves, as in the case of the sphenoids shown in the figures to which reference has already been made in discussing Halstead's case; or that the last posterior ethmoid cell was in relation with both optic nerves, as in Onodi's case.

Onodi<sup>20</sup> addressed letters to various ophthalmologists, with the view of ascertaining the clinical proofs of the influence of disease of the posterior nasal accessory cavities upon the optic nerve. In reply, Schmidt-Rimpler stated that disease of the optic nerve is the result of an affection of the adipose tissue and that there is no real proof that empyema of the sphenoid can, of itself, cause an affection of the optic nerve. Sattler did not consider that unilateral optic neuritis and atrophy were characteristic of diseases of the ethmoid and sphenoid cavities, as they might arise from inflammation, hemorrhage, or tumors at the cerebral end of the optic nerve. Blindness in both eyes with simultaneous empyema of these cavities

might indicate a causal connection if no other cause is present. Axenfeld maintained that diseases of the optic nerve are much rarer than is expected in diseases of the sphenoid. He had seen one case of empyema of the sphenoid with retinal neuritis and two tumors, causing unilateral disturbance of vision. Onodi concludes that, in general, bilateral disturbances of sight are intracranial in origin, but may be due to disease of either the sphenoid or ethmoid.

Fish<sup>8</sup> presents four cases bearing on the subject:

(a) Woman, aet. 37 years, right eye normal, left eye punctate keratitis, vitreal opacities, retinitis, hyperemia of the disk, general edematous condition of the fundus. Resection of the middle turbinate and syringing out the sinus resulted in improving the sight, but the trouble returned whenever the nasal discharge was obstructed.

(b) Opacities of the vitreous, hyperemia of the disk, edema of the fundus, frontal sinusitis. Great improvement followed syringing the sinus.

(c) Attack of grip in 1898, with inflammation and pain in the eye and forehead. At present time there is retinochoroiditis, central and peripheral, disk pale, absolute central scotoma with contraction of the field of vision. Frontal sinusitis and polypi of nose present.

(d) Pain and inflammation for about a week; hyperemia of disk, keratitis, pain in ball and frontal bone, hyperemia middle and inferior turbinate, sinusitis frontalis. Syringing resulted in no improvement at first, but as soon as discharge appeared in the nostril the eye rapidly improved.

Moritz<sup>26</sup> showed that optic neuritis, with sudden loss of vision, may result from compression of the optic nerve at the foramen, or from perineuritis, and that a threatened affection of the optic nerve is shown by hyperemia of the disk.

Pollatschek<sup>25</sup> reports a case of bilateral papillitis, cured by resection of the middle turbinate, curetting of the posterior ethmoid cells and opening the sphenoid sinuses.

Galezowski<sup>10</sup> presented a case in which there was a maxillary sinusitis of dental origin, giving the appearance of an orbital phlegmon. The papilla was edematous, with tortuous veins and hyperemic arteries. Visual acuity was one-fourth, the field of vision being normal. Luc's operation was done; three weeks later all ocular symptoms had disappeared and the vision was normal.

Alexander<sup>1</sup> reports a case of a man, forty-one years of age, who suffered from bilateral optic neuritis, due to empyema of the posterior ethmoid cells and the sphenoid sinus.

Paunz<sup>24</sup> reports a case of papillitis with considerable diminution of vision, due to posterior ethmoid diseases; greatly improved after operation.

Glegg and Hay<sup>11</sup> had a patient in whom there was limitation of the field of vision and reduction of vision to six-twelfths and six-eighteenths, with other ocular symptoms, all being entirely cured by removing the middle turbinate and opening the posterior ethmoid cells.

Green<sup>12</sup> claims that the optic nerve is especially prone to become implicated in sphenoiditis and posterior ethmoiditis, though the involvement is usually slight. If severe and prolonged, retrobulbar neuritis may develop.

Knapp<sup>18</sup> reports a number of cases of orbital abscess and the two following cases without orbital abscess:

(a) Neuro-retinitis following influenza, recovering without treatment.

(b) Retrobulbar neuritis, congestion of the right disk, later central scotoma, deflection of septum, and turbinate hypertrophy; not much improved at first, but later complete recovery.

In the discussion which followed, Kipp stated that he had never seen optic neuritis in connection with sinus disease, except where the infection extended to the orbital tissue; but Randall had seen numerous cases.

Schmiegelow<sup>40</sup> reports two cases of latent empyema of the sphenoid and posterior ethmoid cells, resulting in retrobulbar neuritis:

(a) A boy suddenly taken with pain, malaise, vomiting and later diminished vision in the left eye. The papillary tissues were obscured, borders indistinct, slight swelling, veins dark, tortuous and slightly thickened, macula normal. Vision was greatly improved by resection of the posterior end of the middle turbinate, and opening of the sphenoid sinus.

(b) Young woman, aet. eighteen years, two and a half years before was taken with severe headaches on the left side with reduction of vision on the right side. Headaches improved under treatment. Later, headaches appeared on the right side. Papilla white and atrophic without showing optic neuritis, vision decreased considerably. Very decided improve-

ment followed the resection of the posterior portion of the middle turbinate and the anterior wall of the sphenoid.

Delneuville<sup>7</sup> was able to relieve a patient with reduction of vision to one-half on the left side while the fingers could hardly be counted by the right eye, one meter away, with fundus and medium normal, central scotoma, retrobulbar neuritis, by cleansing and treatment of a sphenoid sinusitis which was present.

Onodi<sup>30</sup> found that relief followed resection of the middle turbinate, removal of polypi and irrigation of maxillary sinus in a man nineteen years of age, who was attacked suddenly with headache, exophthalmus, double vision, and lessened vision.

Packard<sup>32</sup> reports a number of cases:

(a) Margin of left optic nerve hazy, hyperemia of disk, left ethmoiditis and sphenoiditis; improvement of the eye under nasal treatment.

(b) Left optic neuritis, hypertrophy of the left middle turbinate, no pus, bulla ethmoidalis swollen, improvement following treatment.

(c) Right optic neuritis, hypertrophy of the right middle turbinate, improvement following treatment.

(d) Intense hyperemia and edema of both disks, cystic middle turbinates.

(e) Swelling and tortuosity of retinal vessels, acute frontal sinusitis, hypertrophied and cystic middle turbinates.

(f) Retinal vessels overfull, ethmoiditis.

Thompson<sup>42</sup> reports a case in which there were pain for three weeks, paralysis of the third nerve, choked disk, right eye similarly affected but less extensive. After removal of septal spur and treatment of ethmoid and sphenoid condition, vision returned to almost normal.

Posey<sup>37 38</sup> makes the very pertinent remark that there were cases of retrobulbar inflammation of the optic nerve observed in earlier years, following grip and in association with catching cold or rheumatism, which, in place of simple and effective treatment directed towards the sinus, received active and often depressing and harmful general medication. As a consequence, blindness was not the infrequent result, whereas, with proper appreciation of the circumstances attending the origin of the neuritis, complete recovery might have been the ques-

tion of but a few days. Posey maintains that the nerve may be affected from the sinuses by contiguity of tissues from all stages of edema to retrobulbar neuritis.

Sluder<sup>41</sup> reports a case in which there was pain in the right eye for three days, with sudden blindness in both eyes. The right upper lid was edematous. Immediate improvement in vision followed operation.

Risley<sup>39</sup> reports an additional case of optic neuritis, with impaired central vision and contracted fields, recovering after drainage of the frontal and ethmoid sinuses, although the symptoms had lasted three years.

Alfred Wiener<sup>44</sup> reports two cases. (a) Absolute blindness followed an attack of rhinopharyngitis. The middle turbinate bone was resected and the posterior ethmoid cells curetted, first on the right side and then on the left, with evidence of disease at each operation. Vision returned in one eye, but not in the other. Wiener regards the condition as an acute retrobulbar neuritis, occurring in the canalicular portion of the optic nerve, brought about through a posterior ethmoiditis on both sides, probably of syphilitic origin. (b) Complete blindness in a child of nine, following an acute coryza and severe frontal headache. Vision returned in about two weeks after mild local treatment of the nose.

#### METHOD OF ANATOMIC STUDY.

With this array of clinical facts, a study of the anatomic relations of the optic nerve is certainly justified.

Departing somewhat from the practice of Onodi, Zuckerkandl, Hajek, and others, who used their material without special reference to uniformity, I have made these studies on fifteen heads which have been sectioned horizontally. They were first injected through the carotid with a fifty percent formalin solution, then immersed for from three to five months in a three percent solution of hydrochloric acid, in order to decalcify them; then sectioned and reconstructed after the plan designated in my previous papers.<sup>22 23 24</sup> I have taken the sections containing the optic nerve and have dissected out the optic nerve and cut away portions of the walls of the accessory cavities so as to bring into view the most important relations. In some instances the mucosa has been left intact and in others the bony walls alone are shown.

The reconstructions, I consider of great importance, for it is only in this way that it is possible to define accurately, in a series of heads, the diameters of the sinuses, their positions with respect to the optic nerve throughout its course, their variations in graphic form and, at the same time, to preserve the specimens for identification and study. Besides this, it is easy at any time to verify the findings and, if it is desired, to study additional problems in this connection. An illustration of each head is presented, accompanied by the necessary reconstructions, so that the details of this work may be used by other investigators who may be interested in this field of research.

#### MATERIAL FOR STUDY.

The heads, used as material for study, were all obtained from the Anatomical Department of St. Louis University, but there has been, in no instance, a possibility of ascertaining the ante mortem history of the individuals, and, in some cases, the age and sex were unknown, as the heads had been removed from the body before they came into my possession.

#### DESCRIPTION OF HEADS.

The heads are given numbers in the order in which they were reconstructed. Thus far I have reconstructed twenty heads, the last fifteen of which (from VI to XX, inclusive) have been used in this study. In future papers, where reference is made to these heads, the numbers will be given. In papers already published, only the first four heads reconstructed have been utilized—designated A, B, C, D, respectively. These are hereafter to be numbered I, II, III and IV, respectively.

#### HEAD VI. (Figures 1 and 16.)

Sphenoid Sinus.—Left, small, not in relation with optic chiasm which lies behind it. Right, large, extending more than a centimeter posterior to the optic chiasm.

Ethmoid Labyrinth.—Left, two posterior ethmoid cells in relation with optic nerve at their postero-external angles near the roof. Right, posterior ethmoid consists of but one large cell which comes into relation with the optic nerve at the postero-external angle of the cell, its roof slightly overlapping the nerve.

Frontal Sinus.—Left, covers about one-third of the bulbus at its supero-internal portion and extends a somewhat greater distance internal to the globe. Right, smaller than the left, extends over one-sixth of the roof of the globe, its main portion somewhat larger, lying internal.

Optic chiasm lies on the roof of the right sphenoid.

Optic Nerve.—Left, passes along roof of the right sphenoid and the external wall of the left sphenoid, external to the postero-external angle of the posterior ethmoid cell. Right, passes over the external wall of the right sphenoid and external to the postero-external angle of the right posterior ethmoid.

#### HEAD VII. (Figures 2 and 17.)

Sphenoid Sinus—Left, very large, extends to the occipito-sphenoidal articulation posterior to the carotid; optic nerve passes over anterior fourth of the roof. Right, very large, extends to the occipitophenoidal articulation posterior to the carotid; optic nerve passes over anterior fourth of the roof.

Ethmoid Labyrinth.—Left, anterior portion narrow, posterior portion wide, extending somewhat external to the optic nerve, but below it. Last posterior ethmoid in relation with the optic at the postero-external angle. Right, anterior portion narrow, posterior portion wide; last posterior ethmoid in relation with the optic at postero-external angle.

Frontal Sinus.—Left, though quite large, lies almost entirely internal to the globe, overlapping it but slightly. Right, similar in shape and relation to the left, but somewhat smaller.

Optic chiasm extends about an equal distance over the roof of the two sphenoids.

Optic Nerve.—Left, passes over the roof of the left sphenoid then downward to the postero-external angle of the posterior ethmoid. Right, passes over the roof of the left sphenoid and downward to the postero-external angle of the posterior ethmoid.

#### HEAD VIII. (Figures 3 and 18.)

Sphenoid Sinus.—Both fairly uniform, the right reaching a somewhat higher level than the left.

Ethmoid Labyrinth.—Left, posterior portion much wider than the anterior portion, but the only direct relation is at the postero-external angle of the last cell near its roof. Right, anterior ethmoid cells extend posteriorly beyond the posterior

ethmoidal cells, but not in close relation with the optic nerve. The right posterior ethmoid, last cell, in relation with the optic only at its postero-external angle, near the roof.

Frontal Sinus.—Left, very small and not in relation with the globe, being more than a centimeter internal to it, but reaching about the same level as the bulbus. Right, much larger than left, extending more than three centimeters above the globe and overlapping it but slightly.

Optic chiasm lies over posterior portion of the roof of right and left sphenoid, three-fourths being over the right and one-fourth over the left.

Optic Nerve.—Left, passes externally over roof of the sphenoid to the postero-external angle of the last posterior ethmoid cell. Right optic passes externally over the posterior portion of the roof of the sphenoid sinus and over the postero-external angle of the last posterior ethmoid.

#### HEAD IX. (Figures 4 and 19.)

Sphenoid Sinus.—Both fairly uniform, right reaching a slightly higher level. Considerable intervening bone between the roof of the sinuses and the optic chiasm which lies above and behind.

Ethmoid Labyrinth.—Left, anterior portion broad; last posterior ethmoid cell not in close relation with the optic which lies 3 mm. from its postero-external angle. Right, anterior portion broad, last posterior ethmoid cell not in close relation with the optic which lies 3 mm. from its postero-external angle. A second cell presents an angle 4 mm. from the nerve.

Frontal Sinus.—Left, very large, extending a considerable distance anterior to the globe, but overlapping it but slightly. It extends internally beyond the median line. Right frontal much smaller than the left and not in relation with the globe, except at the supero-external portion.

Optic chiasm lies 5 mm. above left sphenoid, 2 mm. above right and behind both of them; no evidence of sulcus opticus on roof of either sphenoid sinus.

Optic Nerve.—Left, passes along lateral and upper wall of left sphenoid and the postero-external angle of the left posterior ethmoid. Right, passes along roof of right sphenoid externally and the postero-external angle of the last posterior ethmoid cell.

## HEAD X. (Figures 5 and 20.)

Sphenoid Sinus.—Left, small. Right, larger, extends above the optic nerve, which runs along the external wall.

Ethmoid Labyrinth.—Left, broader posterior than anterior. Last posterior ethmoid in relation at postero-external angle with the optic nerve. Right, two posterior ethmoid cells in relation with optic nerve at their postero-external angle.

Frontal Sinus.—Left, overlaps the inner portion of the globe but slightly. Right, considerably smaller, lies 3 mm. from the globe at its nearest point.

Optic chiasm in relation almost entirely with the right sphenoid.

Optic Nerve.—Left, passes along the left sphenoid laterally and superiorly, and along the postero-external angle of the last posterior ethmoid. Right, passes along the lateral wall of the sphenoid sinus just below its roof and along the postero-external angle of the last two posterior ethmoid cells.

## HEAD XI. (Figures 6 and 21.)

Sphenoid Sinus.—Both sinuses large and fairly uniform.

Ethmoid Labyrinth.—Both unusually small. Last posterior ethmoid cell on each side 3 mm. from the corresponding optic nerve, the nearest point being the postero-external angle of the cell.

Frontal Sinus.—Left, small, lies considerably internal to the globe. Right, much larger, somewhat more distant from the globe, extends beyond the median line on the left.

Optic chiasm passes over the roof of left and right sphenoid, the left being about two-thirds of the entire distance.

Optic Nerve.—Left, passes over the roof of the left sphenoid and 3 mm. away from postero-external angle of the last posterior ethmoid cell. Right, passes over the roof of right sphenoid and 3 mm. from postero-external angle of the last posterior ethmoid cell.

## HEAD XII. (Figures 7 and 22.)

Sphenoid Sinus.—Left, exceedingly large, in relation with optic chiasm and both optic nerves. Right, very small, 6 mm. below the optic nerve.

Ethmoid Labyrinth.—Left, anterior portion much longer than the posterior; last posterior ethmoid cell shows the usual

relation at its postero-external angle with the optic. Right, anterior ethmoid has the same antero-posterior diameter as the labyrinth, in that its posterior wall extends as far back as the posterior ethmoid cells. The last anterior ethmoid cell is here in relation with the optic nerve at the postero-external angle of the cell, having replaced the posterior ethmoid, which is quite small.

Frontal Sinus.—Left, very large, overlapping the inner wall of the bulbus very slightly. Right, very small, some distance removed from the inner wall of the bulbus.

Optic chiasm lies on the posterior third of the roof of the left sphenoid.

Optic Nerve.—Left, passes from the roof of the left sphenoid to the postero-external angle of the last posterior ethmoid cell. Right, passes over the left sphenoid and to the postero-external angle of the last anterior ethmoid cell.

#### HEAD XIII. (Figures 8 and 23.)

Sphenoid Sinus.—Left, exceedingly large, extending almost as far back as the fifth nerve on both sides, far behind the posterior wall of the right sphenoid (13 mm.). Left optic nerve runs across the superior wall, though the sinus roof extends to a much higher level. Right, much smaller than left, in relation with the optic nerve, which runs along its external and superior wall, though not at its highest level.

Ethmoid Labyrinth.—Left, anterior ethmoid constitutes anterior and large part of the outer portion; last posterior ethmoid cells, two in relation with the optic nerve at the postero-external angle. Right, last posterior ethmoid in but slight relation with the optic at postero-external angle.

Frontal Sinus.—Left, not in relation with the bulbus, most of the cavity being anterior to it. Right, similarly disposed, but somewhat larger.

Optic Chiasm.—Right two-thirds lies on the posterior wall of the right sphenoid, and left third on the superior wall of the left sphenoid.

Optic Nerve.—Left, runs along the superior wall of the left sphenoid below its highest level and just posterior to the postero-external angle of the last two posterior ethmoid cells. Right, runs along the supero-external wall of the right sphenoid and the postero-external angle of the last posterior ethmoid cell.

## HEAD XIV. (Figures 9 and 24.)

Sphenoid Sinus.—Left, small, 4 mm. below the optic nerve. Right, very large, in relation with both optic nerves and chiasm.

Ethmoid Labyrinth.—Left, anterior cells very wide, extending almost as far externally as the frontal; posterior ethmoid composed of one cell only, which is in relation with the optic nerve at the postero-external angle. Right, anterior ethmoid cells similar to those on the left; last posterior ethmoid cell in relation with optic nerve at postero-external angle.

Frontal Sinus.—Left, very large, extending over the inner wall of the orbit and beyond the median line. Right, relation almost identical, but somewhat larger.

Optic chiasm lies posterior to right sphenoid.

Optic Nerve.—Left, runs along the postero-external wall of the right sphenoid and along the postero-external angle of the posterior ethmoid. Right, runs along the posterior wall of the right sphenoid and along the postero-external angle of the posterior ethmoid cell.

## HEAD XV. (Figures 10 and 25.)

Sphenoid Sinus.—Left, in relation with both optic nerves at its postero-lateral wall. Right, insignificant in size, 8 mm. below the optic nerve, appearing as a mere indentation communicating with the nasal cavity by an opening of the usual size.

Ethmoid Labyrinth.—Left, small, last posterior ethmoid in relation with the optic nerve at the postero-external angle just below the roof. Right, very similar to the left.

Frontal Sinus.—Left, very small, not in relation with orbit. Right, smaller, but similar in relation.

Optic chiasm lies behind the left sphenoid about the level of the roof.

Optic Nerve.—Left, runs along the postero-external wall of the left sphenoid and along the postero-external angle of the posterior ethmoid. Right, runs along the postero-external wall of the left sphenoid and along the postero-external angle of the posterior ethmoid.

## HEAD XVI. (Figures 11 and 26.)

Sphenoid Sinus.—Left, small, 8 mm. below optic nerve,

being replaced by an ethmoid cell which is interposed. Right, in relation with the optic nerve at its roof and external wall.

Ethmoid Labyrinth.—Left, large; last posterior ethmoid in relation with optic on the external wall of the cell. Right, large, but relation with the optic nerve is only at the postero-external angle of the last posterior ethmoid cell.

Frontal Sinus.—Left, close to the inner wall of the globe, but does not overlap. Right, but slightly larger and overlaps several millimeters.

Optic chiasm lies entirely behind sphenoid sinuses, in no relation with them.

Optic Nerve.—Left, passes along the external wall of the last posterior ethmoid cell, not in relation with either sphenoid. Right, passes along the external wall of the right sphenoid and postero-external angle of the last right posterior ethmoid.

#### HEAD XVII. (Figures 12 and 27.)

Sphenoid Sinus.—Each sphenoid in about equal relation superiorly with the corresponding nerve and chiasm.

Ethmoid Labyrinth.—Each in relation with corresponding optic nerve at postero-external angle of the last posterior ethmoid.

Frontal Sinus.—Left, large, in relation externally and anteriorly with globe. Right, similar in shape, but smaller and at a greater distance from the globe.

Optic chiasm in relation with both sphenoids.

Optic Nerve.—Left, passes over the roof of the left sphenoid and to the postero-external angle of the posterior ethmoid, slightly below the roof of this cell. Right, passes over the roof of the sphenoid and to the postero-external angle of the posterior ethmoid slightly below the roof of the cell.

#### HEAD XVIII. (Figures 13 and 28.)

Sphenoid Sinus.—Both small, left in relation with optic chiasm and both optic nerves. Right, 7 mm. below optic nerve, being replaced by posterior ethmoid cell which has been interposed.

Ethmoid Labyrinth.—Left, large, usual relation with optic. Right, large, optic nerve passes along external wall of last posterior ethmoid cell.

Frontal Sinus.—Left, large, overlaps inner wall of globe. Right, relation similar to the left.

Optic chiasm in relation with left sphenoid only.

Optic Nerve.—Left, passes above left sphenoid and postero-external angle of the last posterior ethmoid cell. Right, passes over external margin of the roof of the left sphenoid and then downward and outward over the roof of the last posterior ethmoid cell and along its external wall.

#### HEAD XIX. (Figures 14 and 29.)

Sphenoid Sinus.—Left, small, somewhat replaced by the right. Right, extends over to the left side, coming into relation with the left optic nerve at the supero-posterior wall of the sinus.

Ethmoid Labyrinth.—Both small, usual relation to the postero-external angle of the last posterior ethmoid, the left being nearer to the nerve than the right.

Frontal Sinus.—Left, overlaps antero-inferior portion of globe. Right, has about the same relation.

Optic chiasm lies on the postero-superior wall of the right sphenoid.

Optic Nerve.—Left, one-third of the sinus portion lies over the right sphenoid, one-half over the left sphenoid and one-sixth over the postero-external wall of the left posterior ethmoid. Right, runs along and above the right sphenoid, but the anterior half of the portion in relation with this sinus lies laterally. The nerve comes in relation with the last posterior ethmoid cell only at the postero-external portion of the cell.

#### HEAD XX. (Figures 15 and 30.)

Sphenoid Sinus.—Left, very peculiar in shape, consisting of two portions, an upper third and lower two-thirds, united at a constricted point at the level of its nasal orifice. Only the upper portion is in relation with the optic nerves. Right, not in relation with the optic nerve, being 5 mm. below it at its nearest point, which is at the apex of a projection 4 mm. above the main cavity of the sphenoid.

Ethmoid Labyrinth.—Usual relation.

Frontal Sinus.—Left, very large, extending behind the posterior wall of the anterior ethmoid, barely overlapping the inner wall of the globe. Right, extends almost as far posteriorly, but not so far as the anterior ethmoid cells, overlapping the globe a somewhat greater distance than on the left side.

Optic chiasm lies posterior to left sphenoid sinus.

Optic Nerve.—Left, runs along external wall of the left sphenoid and on the postero-external angle of the last posterior ethmoid cell. Right, runs along the external wall of the left sphenoid and the postero-external angle of the last posterior ethmoid cell, right side being a trifle higher than this ethmoid cell.

#### DESCRIPTION OF THE SINUSES.

The maxillary sinuses of the fifteen heads are not described in detail, as it was deemed inexpedient to burden the report with it, and as the maxillary sinus does not enter into the subject to the same degree as the other sinuses. However, in each case it has been reconstructed in the lateral projections which have been made, and the diameters and other important particulars are given.

In order to avoid repetition, the measurements are all given in millimeters. The reconstructions are all exact within a possible error of 1 mm.

#### SPHENOID SINUS.

There is a tremendous variation in the dimensions of the thirty sphenoid sinuses, as shown in the following table:

#### DIAMETERS OF THE SPHENOID SINUSES.

HEAD.	Antero-posterior.		Supero-inferior.		Lateral.	
	R.	L.	R.	L.	R.	L.
VI.	35	15	30	24	31	12
VII.	42	36	22	34	34	25
VIII.	25	20	27	25	16	12
IX.	21	14	23	17	17	13
X.	17	14	22	20	17	11
XI.	31	27	26	26	14	19
XII.	9	39	8	26	7	24
XIII.	16	33	36	36	14	27
XIV.	24	10	38	18	35	10
XV.	2	23	4	27	2	21
XVI.	20	9	21	10	14	8
XVII.	24	14	24	19	17	17
XVIII.	9	19	10	19	9	24
XIX.	32	20	28	17	27	12
XX.	29	30	21	27	28	34

The antero-posterior diameter varies from 2 in Head XV to 42 in Head VII, left; the supero-inferior from 4 in Head

XV, right, to 38 in Head XIV, right; lateral from 2 in Head XV, right, to 35 in Head XIII, right.

The sphenoid sinus of Head XV (figure 25) is by far the smallest, with diameters 2, 4 and 2, the next smallest being Head XII (figure 22), right, with diameters 9, 8 and 7. That of Head VII (figure 17), right side, is the largest with diameters 42, 22 and 34, while that of Head VI (figure 16), right, is next largest, with diameters 35, 30 and 31.

The average diameters of the thirty sinuses are as follows: Antero-posterior 21.5, supero-inferior 22.8, lateral 18.4. Excluding five extremes, smallest and largest, the range of the remaining twenty, which may be considered as common, is as follows: antero-posterior 14 to 32, supero-inferior 17 to 27, lateral 11 to 27.

A glance at the reconstruction of the sphenoid sinuses (figures 16 to 30) shows the great variety of size and shape. The right sphenoid of Head XV is but little larger than its opening into the nasal cavity, which is in its accustomed position. It is replaced almost entirely by the left sphenoid, which is shown in relation with the optic chiasm, and both nerves (figure 25). Both sphenoids of Head VII are exceedingly large (figure 17) and extend far behind the optic chiasm, sharing this feature with Head VI, right (figure 16), Head XII, right (figure 22), Head XIII, left (figure 23), Head XVII, right (figure 27), and Head XIX, right (figure 29).

There is likewise great disparity in the size of the two sphenoid sinuses in Heads VI (figure 16), XII (figure 22), XIV (figure 24), XV (figure 25), and XIX (figure 29). One sphenoid only is in relation with both optic nerves in Heads XII (figures 7 and 22) left, XIV (figures 9 and 24) right, XV (figures 10 and 25) left, XVIII (figures 13 and 28) left, XX (figures 15 and 30) left.

Each sphenoid sinus is in relation with the corresponding optic nerve, and one is in relation with the other optic nerve in addition in the following instances: Heads VI (figures 1 and 16) and XIX (figures 14 and 29).

In Head XVI neither sphenoid is in relation with the left optic nerve (figures 11 and 26). A large posterior ethmoid cell (figure 11) replaces a small left sphenoid.

The relation is fairly uniform in the following: Heads VII (figures 2 and 17), VIII (figures 3 and 18), IX (figures

4 and 19), X (figures 5 and 20), XI (figures 6 and 21), XIII (figures 8 and 23) and XVII (figures 12 and 27).

The orifice of the sphenoid sinus, while invariably opening into the nose above the superior turbinate, varies considerably in its position. The following table shows the distance between the inferior margin of the opening and the lowest level of the floor and the highest level of the roof, respectively:

DISTANCE BETWEEN THE INFERIOR MARGIN OF THE NASAL  
OPENING OF THE SPHENOID SINUS AND THE FLOOR  
AND ROOF OF THE SINUS.

Heads.	Right		Left	
	Floor	Roof	Floor	Roof
VI.	17	13	13	11
VII.	7	15	20	14
VIII.	13	14	11	16
IX.	10	13	4	13
X.	13	9	8	12
XI.	12	14	11	15
XII.	4	4	14	12
XIII.	15	21	17	19
XIV.	16	22	8	10
XV.	2	2	14	13
XVI.	7	14	3	7
XVII.	12	12	7	12
XVIII.	6	4	5	14
XIX.	21	7	9	8
XX.	19	2	17	10

These figures certainly show a wide variation, and yet it may be said that the orifice, as a rule, is midway between the roof and the floor. This is true for twenty out of thirty sinuses.

In XVIII, XIX, XX right and VII, XVIII and XIX left, the orifice is in the upper third; in XI right and IX, XI and XVII left it is in the lower third; in the other thirty instances it is in the middle third.

It is relatively highest in Head XX, right, where its distance from the roof is one-tenth of that between the roof and the floor. It is relatively lowest in IX, left, where it opens in the lower quarter of the anterior wall.

The more specific relations of the optic nerve and chiasm will be discussed under those heads.

## ETHMOID LABYRINTH.

Until Onodi pointed out that the last posterior cell was at times in close relation with the optic nerve, it was generally supposed that this relation was confined to the sphenoid exclusively, but since that time his investigations have been confirmed that the last posterior ethmoid cell may replace the sphenoid in both position and relation.

The study here presented is for the purpose of establishing how extensive this relation is and, to this end, the entire ethmoid labyrinth is reconstructed superiorly and shown in figures 16 to 30. The anterior cells occupy the space within the dotted lines, the posterior cells within the unbroken lines, while the solid black spaces represent that portion of the last ethmoid cavity in relation with the optic nerve, or perhaps it would be more explicit to say that it is a superior reconstruction of that position of the last posterior ethmoid cavity which lies at the level of the optic cells. The space outside of this, inclosed in the unbroken lines, represents that additional portion of the posterior ethmoidal cavities not in relation with the optic nerve.

The dimensions of the ethmoid labyrinth are as follows:

DIAMETERS OF THE ETHMOID LABYRINTH.

HEAD	Labyrinth			Anterior Ethmoid			Posterior Ethmoid			
	Antero-posterior.	Supero-inferior.	Lateral.	Antero-posterior.	Supero-inferior.	Lateral.	Antero-posterior.	Supero-inferior.	Lateral.	
VI,	Right	37	23	18	23	22	8	28	23	28
	Left	36	20	13	22	15	9	20	17	12
VII,	Right	43	34	26	22	31	8	26	34	27
	Left	47	35	20	27	12	9	30	36	20
VIII,	Right	32	26	19	32	20	16	22	17	11
	Left	47	32	26	24	25	11	22	32	26
IX,	Right	34	39	20	21	33	18	23	26	12
	Left	30	36	20	20	32	19	21	28	23
X,	Right	35	28	14	19	25	11	20	17	13
	Left	35	28	15	21	26	15	22	19	14
XI,	Right	24	33	15	10	26	11	20	18	13
	Left	23	29	16	14	27	11	17	15	16
XII,	Right	40	20	12	40	17	12	15	6	8
	Left	34	17	12	30	17	9	13	10	11
XIII,	Right	35	31	12	14	18	9	26	23	12
	Left	35	35	18	26	35	14	25	31	18
XIV,	Right	45	59	26	26	57	26	27	30	17
	Left	46	57	28	30	50	29	32	31	12
XV,	Right	32	26	9	9	7	24	24	20	9
	Left	37	26	11	17	8	26	20	22	11
XVI,	Right	32	40	15	20	35	14	22	26	12
	Left	35	31	22	19	28	18	28	23	16
XVII,	Right	27	19	12	9	19	7	18	17	11
	Left	22	18	10	12	16	10	16	17	10
XVIII,	Right	54	33	16	22	18	14	14	28	15
	Left	38	25	15	30	34	12	33	23	15
XIX,	Right	24	25	11	16	25	13	17	18	11
	Left	25	28	11	15	28	11	17	20	9
XX,	Right	35	40	15	28	38	11	27	35	14
	Left	32	42	13	15	29	12	25	38	13

These figures show the following:

Ethmoid Labyrinth.—Range, antero-posterior diameter 22 to 54, supero-inferior 17 to 59, lateral 9 to 28. Usual, leaving out five highest and lowest, antero-posterior 27 to 43, supero-inferior 23 to 36, lateral 12 to 20. Average, antero-posterior 35, supero-anterior 31.6, lateral 16.3.

The largest is that of Head XIV, left, 46, 57, 28, and the smallest, Head XVII, left, 22, 18, 10.

Anterior Ethmoid.—Range, antero-posterior 9 to 40, supero-inferior 7 to 57, lateral 7 to 29. Usual, leaving out five highest and lowest, antero-posterior 14 to 27, supero-inferior 17 to 34, lateral 9 to 18. Average, antero-posterior 21, supero-inferior 25.6, lateral 14.

The largest is that of Head XIV, left, 30, 50, 29, and the smallest that of head XVII, right, 9, 19, 7.

Posterior Ethmoid.—Range, antero-posterior 13 to 33, supero-inferior 6 to 38, lateral 8 to 28. Usual, leaving out five highest and lowest, antero-posterior 17 to 26, supero-inferior 17 to 31, lateral 11 to 18. Average, antero-posterior 22.3, supero-inferior 23.3, lateral 14.7.

The largest is that of Head VII, left, 30, 36, 20, and the smallest that of Head XII, right, 15, 6, 8.

The anterior ethmoid cells, while constituting in part the inner wall of the orbit, are not in close relation with the optic, as may be readily ascertained by examination of figures 16 to 30. However, there is a fairly close relation in Heads VIII, XII and XIV.

Onodi mentions a case where the anterior ethmoid came into close relation with the optic nerve. Head XII (figures 7 and 22) exhibits a cell of this character.

The posterior ethmoid, on the contrary, has almost always a very close relation. It may replace the sphenoid and the nerve thereby comes into relation with the external wall, as shown in Head XVI (figures 11 and 26) and XVIII (figures 13 and 28). Under other circumstances the relation is a very slight one, being confined to the postero-external angle at the roof. That there is this slight relation may be easily ascertained by examining the reconstructions, figures 16 to 30. In practically all, the optic nerve may be seen close to this postero-external angle.

#### FRONTAL SINUS.

While there is a great diversity of shapes to be found in the different frontal sinuses, there is rather more uniformity of shape and size in the two frontals of the same head. The dimensions are as follows:

## DIAMETERS OF THE FRONTAL SINUS.

HEAD.	Antero-posterior.		Supero-inferior.		Lateral.	
	R.	L.	R.	L.	R.	L.
VI.	15	18	24	30	20	32
VII.	32	33	28	26	22	26
VIII.	22	16	51	28	25	11
IX.	17	21	27	36	21	37
X.	17	17	40	37	27	22
XI.	22	16	38	38	22	15
XII.	16	22	34	45	10	27
XIII.	17	13	25	22	21	18
XIV.	26	21	45	37	42	37
XV.	9	12	14	24	7	11
XVI.	12	13	35	30	26	21
XVII.	26	30	35	43	17	23
XVIII.	28	21	39	41	25	30
XIX.	12	17	30	31	28	20
XX.	26	31	46	45	32	24

The variations in the size of the frontal may be summed up as follows:

Range, antero-posterior 9 to 33, supero-inferior 14 to 51, lateral 7 to 42. Usual, leaving out five highest and lowest; antero-posterior 15 to 26, supero-inferior 26 to 40, lateral 17 to 30. Average, antero-posterior 21, supero-inferior 34, lateral 23.

The largest is that of Head XIV, right, 26, 45, 42, and the smallest that of Head XV, right, 9, 14, 7.

That the frontal in these heads has not any close relation with the optic nerve, but with the bulbus opticus, is made manifest in figures 16 to 30. Thus the frontal is shown to be more than 3 mm. from the bulbus in Heads VIII, left (figure 18), XI, both sides (figure 21), XII, right (figure 22), XIII, both sides (figure 23), XV, both sides (figure 25), XVII, right (figure 27). The overlapping is considerable in Heads VI, both sides (figure 16), IX, left (figure 19), XIV, both sides (figure 24); in only one instance, Head XV, both sides (figure 25), does the frontal fail to reach a higher level than the bulbus.

## MAXILLARY SINUS.

Although the upper wall of the maxillary sinus constitutes a portion of the floor of the orbit, the optic nerve is quite far from the sinus.

The following are the measurements of the diameters of the thirty sinuses, the distance from the optic nerve at the

nearest points, and the distance between the lowest margin of the nasal opening of the sinus, and the floor of the sinus:

DIAMETERS OF THE MAXILLARY SINUS, DISTANCE FROM OPTIC NERVE AT THE NEAREST POINT AND DISTANCE BETWEEN THE LOWEST MARGIN OF NASAL OPENING OF THE SINUS AND FLOOR OF THE SINUS.

HEAD.	Antero-posterior.		Supero-inferior.		Lateral.		Nearest point to optic nerve.			Distance of opening from floor of cavity.	
	R	L	R	L	R	L	R	L	R	L	
VI.	39	40	42	32	30	25	10	11	36	28	
VII.	40	42	41	47	28	29	13	17	32	39	
VIII.	32	30	28	29	19	18	16	25	24	25	
IX.	17	20	17	21	8	11	18	15	15	14	
X.	39	37	37	40	33	30	7	7	36	38	
XI.	40	40	37	39	31	29	10	11	33	34	
XII.	34	29	28	28	28	25	12	10	21	23	
XIII.	37	40	45	43	29	32	10	7	32	32	
XIV.	37	42	38	40	25	25	22	17	23	21	
XV.	40	33	38	34	24	26	15	16	33	30	
XVI.	25	26	23	26	15	17	16	14	18	24	
XVII.	35	37	31	33	32	23	13	17	22	25	
XVIII.	35	26	38	26	26	19	7	7	33	21	
XIX.	36	42	45	42	27	32	8	12	40	38	
XX.	36	35	39	36	25	21	21	21	36	28	

The variations are as follows:

Range, antero-posterior diameter 17 to 42, supero-inferior 17 to 47, lateral 8 to 33, nearest point to optic nerve 7 to 25, orifice to floor 14 to 40. Usual, leaving off highest and lowest five; antero-posterior 29 to 40, supero-inferior 28 to 42, lateral 19 to 30, nearest point to optic nerve 8 to 17, orifice to floor 21 to 36. Average, antero-posterior 38, supero-inferior 38, lateral 23.8, nearest point to optic nerve 13.5, orifice to floor 29.

The largest is in Head VII, left, 42, 47, 29, the smallest in Head IX, right, 17, 17, 8. It will be noted that leaving out a few of the extremes, the maxillary sinuses are more uniform than any of the sinuses.

The optic nerve comes within 7 mm. of the maxillary sinuses in Head X, both sides; XIII, left; and XVIII, both sides. The greatest distance is found in Head VIII.

## OPTIC CHIASM.

The optic chiasm in these heads is in the main in relation with one or more sphenoid sinuses. It is directly upon the roof in Heads VI, both sides (figures 1 and 16); VII (figure 17); XII, both sides (figure 22); XIII, left (figure 23); XV, both sides (figure 25); XVII, right (figure 27); XVIII, both sides (figure 28); XIX, both sides (figure 29).

It lies considerably above the roof in Heads VII, right (figure 17); VIII, left (figure 18); XVI, left (figure 26).

It lies posterior to the sphenoid sinus in Heads VIII, both sides (figure 18); IX, both sides (figure 19); X, both sides (figure 20); XI, both sides (figure 21); XIII, right; XIV, both sides; XVI, both sides (figure 26); XVII, left (figure 27); XX, both sides (figure 30).

It is thus seen that in more than half of the instances the chiasm lies posterior to the sphenoidal cavity. Special attention is called to Heads VI, VII, XII, XIII, XVII, XIX, where a considerable portion of the sphenoidal cavity lies beyond the anterior margin of the optic chiasm.

No other cells among these specimens come into relation with the optic chiasm.

## OPTIC NERVE.

The optic nerve may be described as passing externally from the chiasm along the roof, or lateral wall of the sphenoid sinus in slight relation, usually, with the last posterior ethmoid cell, and from thence to the bulbus opticus through the peri-orbita.

It may be divided into a sinus portion and a free portion. Under the former term, I include that part of the nerve in immediate relation with the accessory cavities of the nose, or (arbitrarily) within 3 millimeters of the sinus wall.

The following measurements show the length of the nerve in the different heads:

## LENGTH OF OPTIC NERVE.

HEAD.			Free Portion.		Sinus Portion.	
	Right.	Left.	R.	L.	R.	L.
VI.	44	44	21	22	23	22
VII.	54	55	22	24	32	31
VIII.	40	40	21	20	19	20
IX.	45	45	18	20	27	25
X.	37	34	18	15	19	19
XI.	54	55	26	26	28	29
XII.	45	44	22	23	23	21
XIII.	39	40	15	12	24	28
XIV.	43	40	15	14	28	26
XV.	54	47	28	27	26	20
XVI.	43	44	19	18	24	26
XVII.	40	40	19	23	21	17
XVIII.	48	45	23	20	25	25
XIX.	39	37	15	14	24	23
XX.	44	44	21	23	23	21

The following variations are obtained:

Optic nerve: range, 34 to 55; usual, leaving off highest and lowest five, 40 to 48; average, 44.

Free portion: range, 12 to 28; usual, leaving off highest and lowest five, 15 to 23; average, 20.

Sinus portion: range, 17 to 32; usual, leaving off highest and lowest five, 21 to 28; average, 24.

It is therefore clear that, at least in these heads, the sinus portion of the optic nerve is a trifle greater than the free portion.

There does not appear to be any correspondence between the length of the optic nerve and the extent of accessory cavities. Where the sphenoid is very large, the optic nerve has its origin in the chiasm on the roof of the sphenoid, some distance anterior to the posterior wall of the sinus, as, for instance, in Heads VI, right (figure 16); VII, both sides (figure 17); XII, both sides (figure 22); XIII, both sides (figure 23); XX, both sides (figure 30).

Where the cells are small, the optic nerve leaves the chiasm generally behind the sinus, as seen in Heads VIII (figure 18); IX, both sides (figure 19); X, both sides (figure 20); XVI, both sides (figure 26). Head XVIII (figure 28), is somewhat at variance with this rule, but, under any circumstances, it does not appear possible to assign to the extent of the sinus an explanation of the varying size of the optic nerve.

The reconstructions (figures 16 to 30) show that there is no constancy in the relation of the sphenoid to the optic nerve.

This has already been considered in discussing the sphenoid sinus; but the relation which the sphenoid opening bears to the optic nerve is still to be considered. It is seen to vary greatly in the distance between them.

The following table of measurements shows this difference:

DISTANCE LOWER SURFACE OF OPTIC NERVE AND NASAL  
OPENING OF SPHENOID.

Head.	Right.	Left.
VI	9	6
VII	6	6
VIII	2	6
IX	6	7
X	3	2
XI	9	12
XII	9	3
XIII	5	0
XIV	14	14
XV	8	5
XVI	12	11
XVII	5	5
XVIII	1 above	2 above
XIX	1 above	1
XX	8	12

Range, 2 above to 14; usual, leaving off highest and lowest five, 2 below to 11; average, 6.

In two instances, Heads XVIII, both sides (figure 28), and XIX, right (figure 29), the orifice is above the lower surface of the optic, and in XIII, left, it reaches the same level. In eight instances out of the thirty, the optic nerve lies within 3 mm. of the level of the orifice of the sinus.

It has already been pointed out that the usual rule is that the optic nerve comes into relation with the postero-external angle of the last posterior ethmoid cell at its roof, and from this point it passes in an external direction through the peri-orbita to the bulbus. The space between the nerve and the ethmoid labyrinth increases in almost direct proportion as the nerve approaches the bulbus, and its junction with the bulbus is generally the position of greatest distance from between the nerve and the ethmoid labyrinth.

In only one case, Head XII (figures 7 and 22), does the anterior ethmoidal cell come in close relation with the optic nerve, replacing a posterior ethmoid cell which lies below it. The relation which the nerve bears to the last posterior ethmoid, when that cell replaces the sphenoid, is very character-

istic, for, in every instance in which this replacement had taken place in the heads examined, the nerve is found to run along the external wall of the cavity. This increases the ethmoid portion very considerably, changing it from a course along an angle, apparently made for that purpose, to a wall which it follows in an almost surprising manner.

The frontal is relatively quite distant from the optic nerve, the nearest point being, as a rule, to the inner side of the orbit, and here is much further away than the corresponding anterior ethmoid cells, which ordinarily lie anterior to it at the level of the optic nerve. In some instances, however, the frontal reaches a point far back along the anterior ethmoid cells; for example: Heads VII, X, XI, XII, left; XV, XVII, XVIII, XX (figures 17, 20, 21, 22, 25, 27, 28 and 30). In all the cases the sinus is much closer to the optic nerve than where the sinus remains anterior.

In all the specimens the periorbital fat makes a close relation with the maxillary sinus impossible, although, in some instances, the distance is less than 10 mm.

#### SUMMARY.

To summarize, the following has been observed in the study of these fifteen heads, with respect to the relation of the optic nerve to the accessory cavities of the nose:

1. The sphenoid sinuses vary as follows: Antero-posterior diameter, 2 to 42 mm.; supero-inferior, 4 to 36 mm.; lateral, 2 to 35 mm.; averaging, respectively, 21.5, 22.8, 18.4.
2. The opening of the sphenoid into the nose, in the great majority of cases, is about midway between the floor and the roof of the sinus. In some instances it is much closer to the roof.
3. The diameter of the ethmoid labyrinth and its component parts, the anterior and posterior ethmoid cells, vary as follows: Labyrinth, antero-posterior 22 to 54 mm., supero-inferior 17 to 59 mm., lateral 9 to 28 mm.; anterior ethmoid cells, antero-posterior 9 to 40 mm., supero-inferior 7 to 57 mm., lateral 7 to 29 mm.; posterior ethmoid cells, antero-posterior 13 to 32 mm., supero-inferior 6 to 38 mm., lateral 8 to 28 mm.
4. The diameters of the frontal sinus vary as follows:

Antero-posterior 9 to 33 mm., supero-inferior 14 to 51 mm., lateral 7 to 42 mm.

5. The diameters of the maxillary sinuses vary as follows: Antero-posterior 17 to 42 mm., supero-inferior 17 to 47 mm., lateral 7 to 33 mm.

6. The optic chiasm is usually in relation with one or both sphenoid sinuses; in no instance, in these heads, with the ethmoid. In more than half of the heads it lies posterior to the sphenoid cavity.

7. The optic nerve may be divided into sinus portion and a free portion, of which the former is usually the larger, as shown by the variations, as follows:

Optic nerve 34 to 55 mm., sinus portion 17 to 32 mm., free portion 12 to 28 mm. As far as could be ascertained, there is nothing in the extent and shape of the sinuses to account for the variation in the length of the nerves.

8. In five instances (one-third) one sphenoid is in relation with both optic nerves, the other sphenoid not participating; in two, the other sphenoid participates in the relation, and in one there is no relation between either sphenoid and one of the optic nerves.

9. There is a considerable variation in the distance between the optic nerve and the level of the lower margin of the nasal opening of the sphenoid from 2 mm. above to 14 mm. below. In four instances the opening is at the level of or above the optic nerve.

10. As a rule, the last posterior ethmoid cell (sometimes there are two) has a very slight relation with the optic nerve, at the postero-external angle just at the roof and from this point the nerve passes externally to the bulbus, gradually increasing the distance which separates it from the labyrinth. In one instance an anterior ethmoid replaces the posterior ethmoid cell and assumes the usual relation of the last posterior ethmoid cell. When the last posterior ethmoid cell replaces the sphenoid, the optic nerve runs along the external wall of the ethmoid.

11. The frontal is not in close relation with the optic nerve, except when it extends posteriorly in the region of the ethmoid cells. It is commonly in relation with the bulbus, but sometimes it is far removed from it.

12. The roof of the maxillary sinus, forming the inferior

wall of the orbit, is below the bulbus and does not reach a distance nearer than 7 mm. from the optic nerve.

#### CLINICAL DEDUCTIONS.

In view of the cases of optic nerve involvement, due to sinus disease, as abstracted, and of the anatomic study described in this paper, the following clinical deductions are justified:

1. Optic nerve involvement without periorbital abscess, although heretofore thought to be an infrequent sequella, is common enough to merit consideration in sinus affections.

2. There have probably been many unreported cases.

3. In all likelihood many minor symptoms resulting from transitory involvement have been overlooked.

4. Whether the infection be lymphogenous or hematogenous, or by contact, the smaller the distance from the infecting focus, the greater will be the chance of the involvement of the nerve.

5. It, therefore, is uncommon for frontal or maxillary sinusitis to be accompanied by optic nerve disease without periorbital involvement. However, from their relation to the bulbus, disease by extension through it is not to be overlooked.

6. Sphenoid sinusitis would naturally be called to account as the prolific cause of the infection, but the sphenoid is less commonly affected than the other sinuses, and, except in closed empyema, the pus is evacuated in a large measure through its nasal opening. Stagnant and decomposing pus is more or less common on the floor, in sphenoid empyema, in that part farthest removed from the optic nerve; but this factor becomes more potent where the orifice is at the level or above the optic nerve, as shown in the four heads, and the likelihood of trouble is greatly increased by the immediate propinquity of the stagnant and decomposing pus, which, in these cases, is separated from the nerve only by a thin lamina of bone and the nerve sheath.

The seven heads out of fifteen, shown and described in this paper, in which one sphenoid is in relation with both optic nerves, afford sufficient explanation for contralateral optic neuritis when caused by sinus disease.

7. The anterior ethmoid cells, which are so commonly affected with suppurative inflammation, are so far from the nerve that they are not likely to influence the optic nerve, ex-

cept through the effect on the periorbita adjoining. However, where an anterior ethmoid cell is extensive enough to come into relation with the nerve by replacing a posterior ethmoid cell, as in Head XII, trouble is more likely to occur.

8. The posterior ethmoid cells, also frequently affected, have very little influence on the optic nerve on account of the meagerness of their relation, viz., the postero-external angle at the roof of the cell, as I have pointed out in this paper. When the cell replaces the sphenoid and the optic nerve passes along the external wall, then the posterior ethmoid becomes the most potent factor of all, for the nerve is closer to the mass of pus and for a greater distance than under any other circumstances, even though the nasal opening may be in the dependent portion of one part of the cell.

9. It, therefore, becomes necessary to study more carefully the cases in which the sphenoid orifice is near the optic nerve and in which the sphenoid is replaced by a surmounting ethmoid cell.

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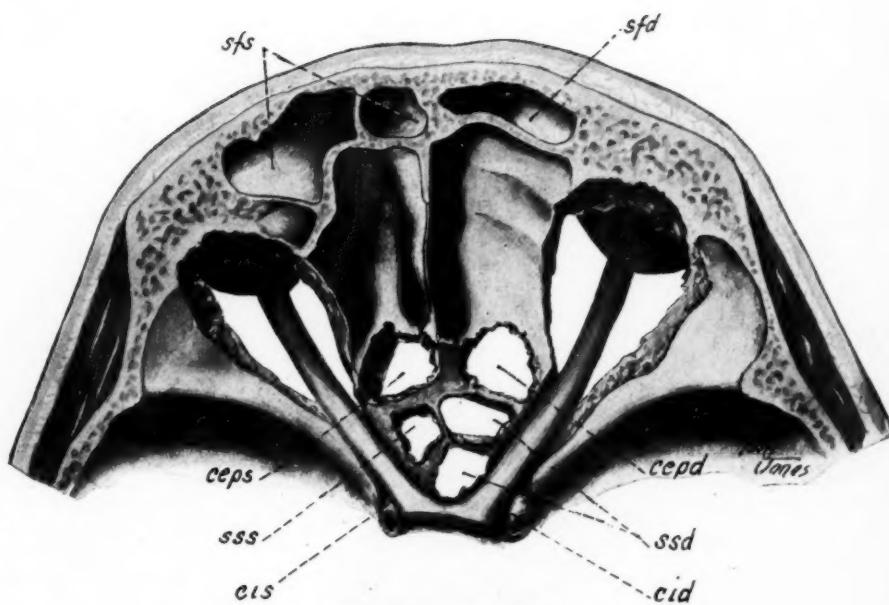
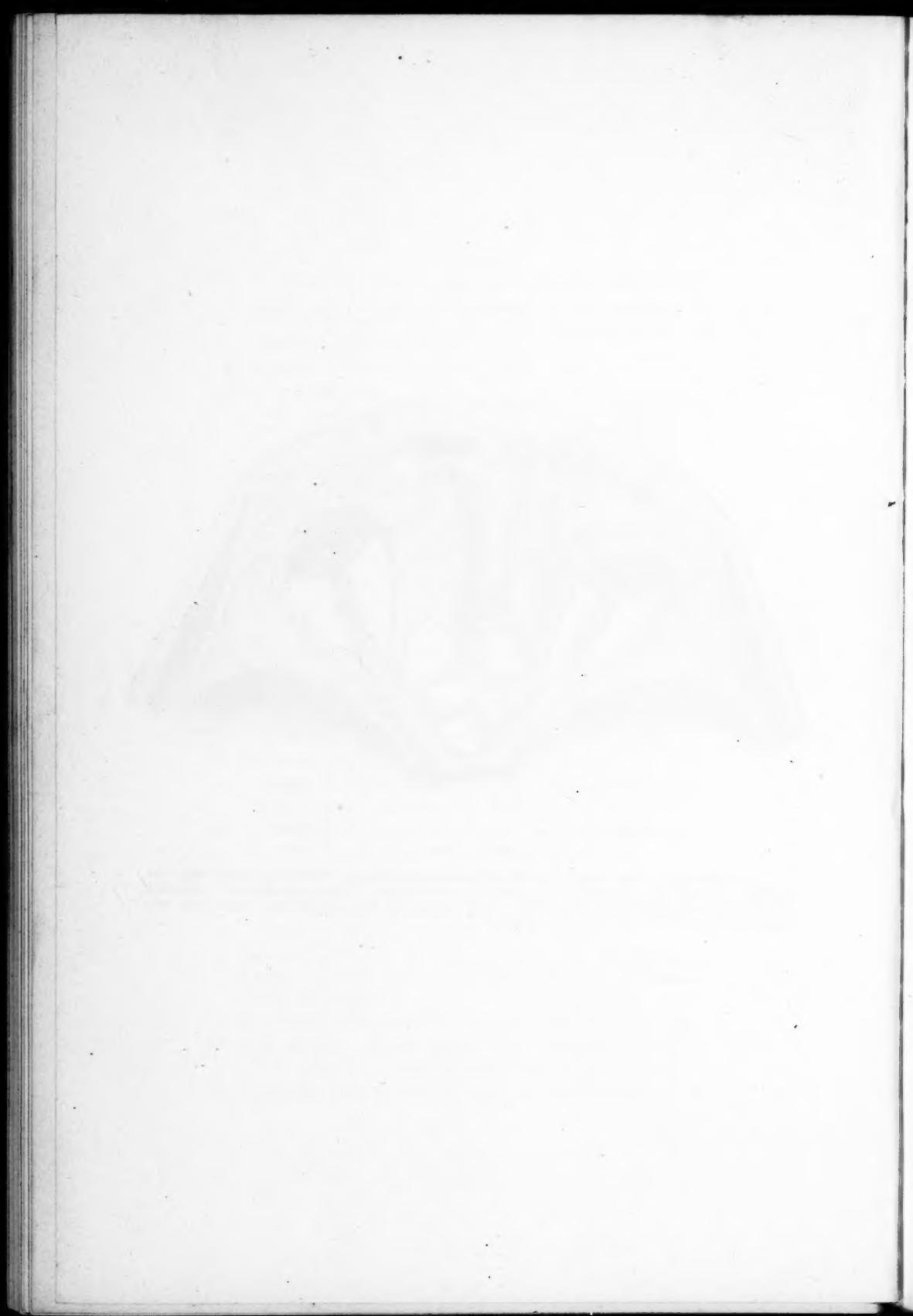


FIGURE 1. HEAD VI.

Left sphenoid (sss) small, not in relation with chiasm; right sphenoid (ssd) apparently double, on account of a ridge, in relation with chiasm posteriorly; relation of posterior ethmoid cells (ceps, cepd,) well shown, at postero-external angle; sfs, sfd, frontal sinuses; cis, cid, internal carotid.



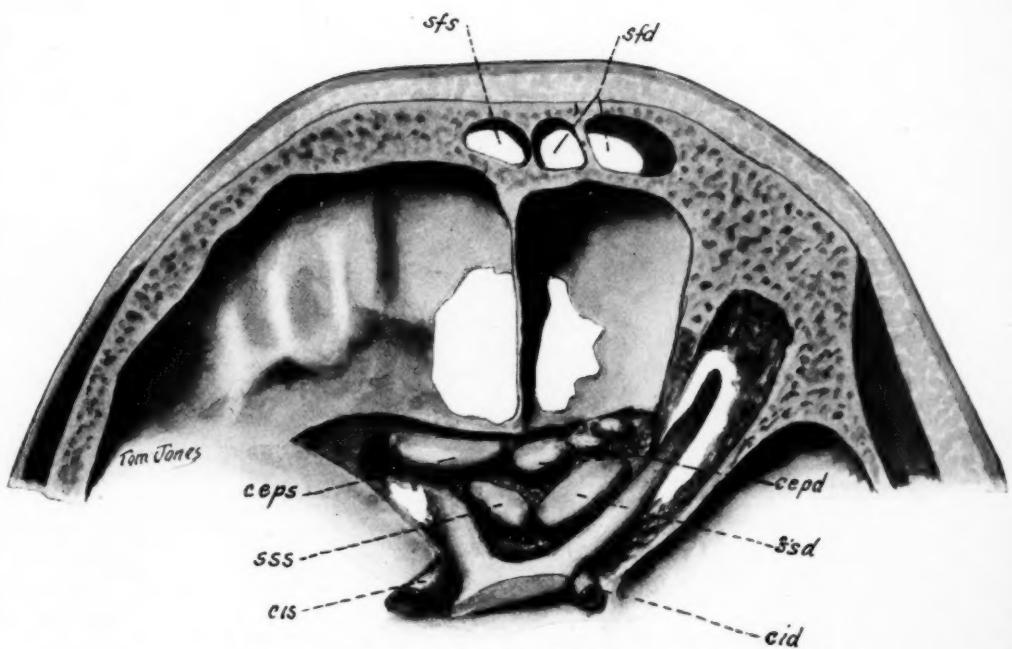


FIGURE 2. HEAD VII.

Mucosa of sphenoid (sss, ssd) and posterior ethmoid (ceps, cepd), left intact; relation to optic nerve shown; right frontal (sfs) apparently double on account of ridge of bone; cis, cid, carotid arteries.



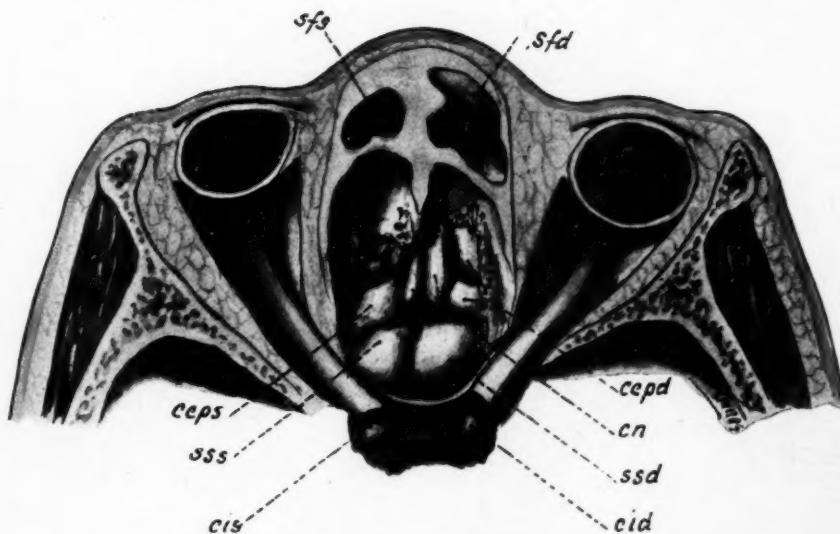
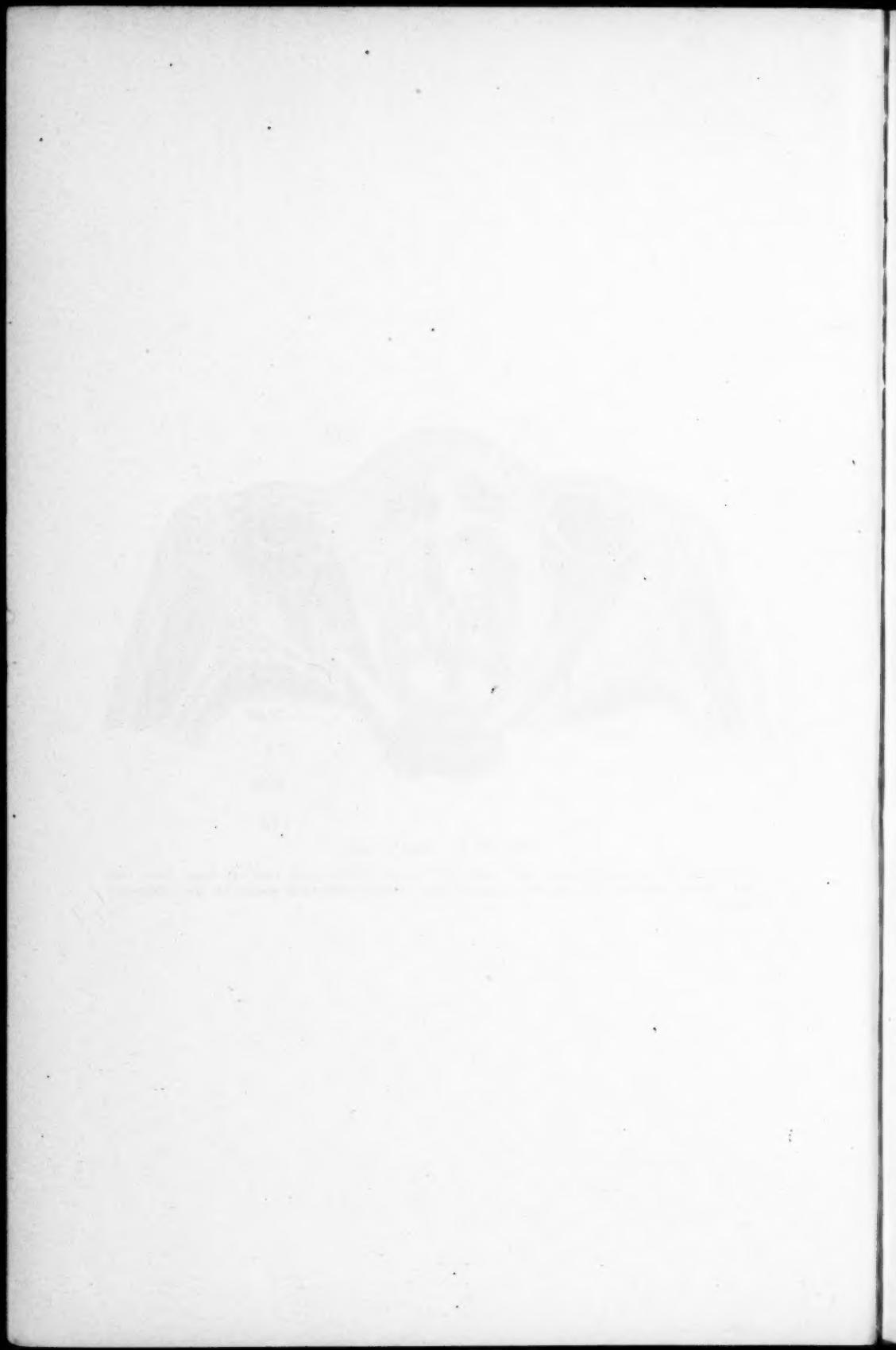


FIGURE 3. HEAD VIII.

Mucosa of sphenoid (sss, ssd) ethmoid (ceps, cepd) and roof of nose (cn) left intact. Note relation of sphenoid sinuses and postero-external angle of the posterior ethmoid.



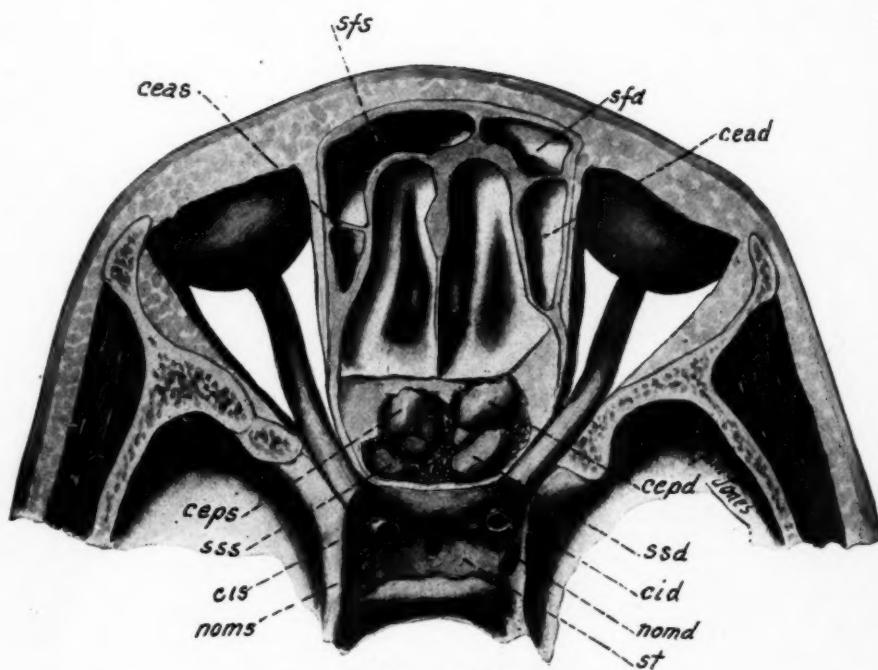
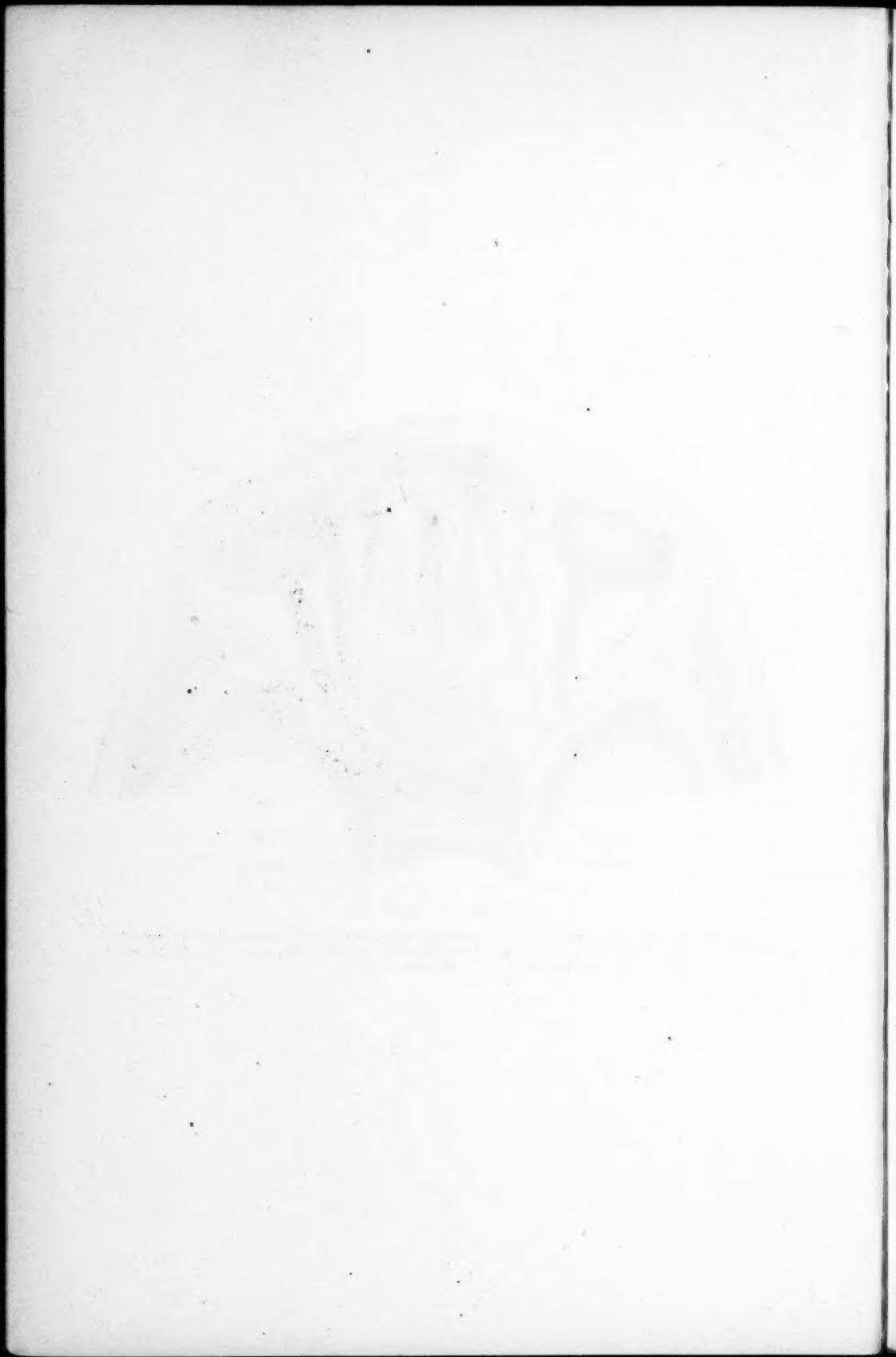


FIGURE 4. HEAD IX.

Sphenoid (sss, ssd) and posterior ethmoid (ceas, cepd) with mucosa intact; anterior ethmoid (ceas, cead) unusually high in relation with frontal (sfs, sfd); cis, cid, internal carotid; nomd, nomd, oculomotor nerve; st, sella turcica.



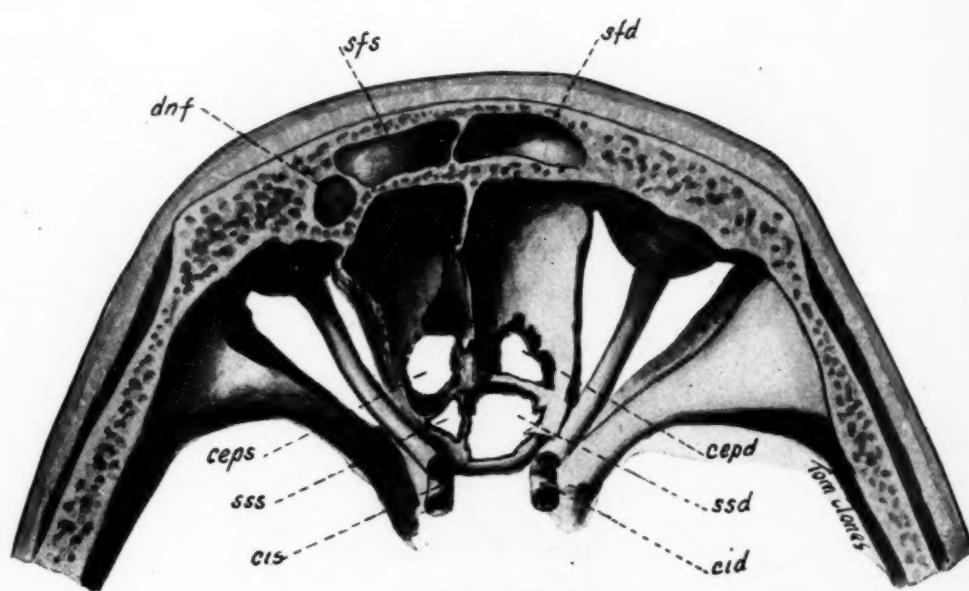
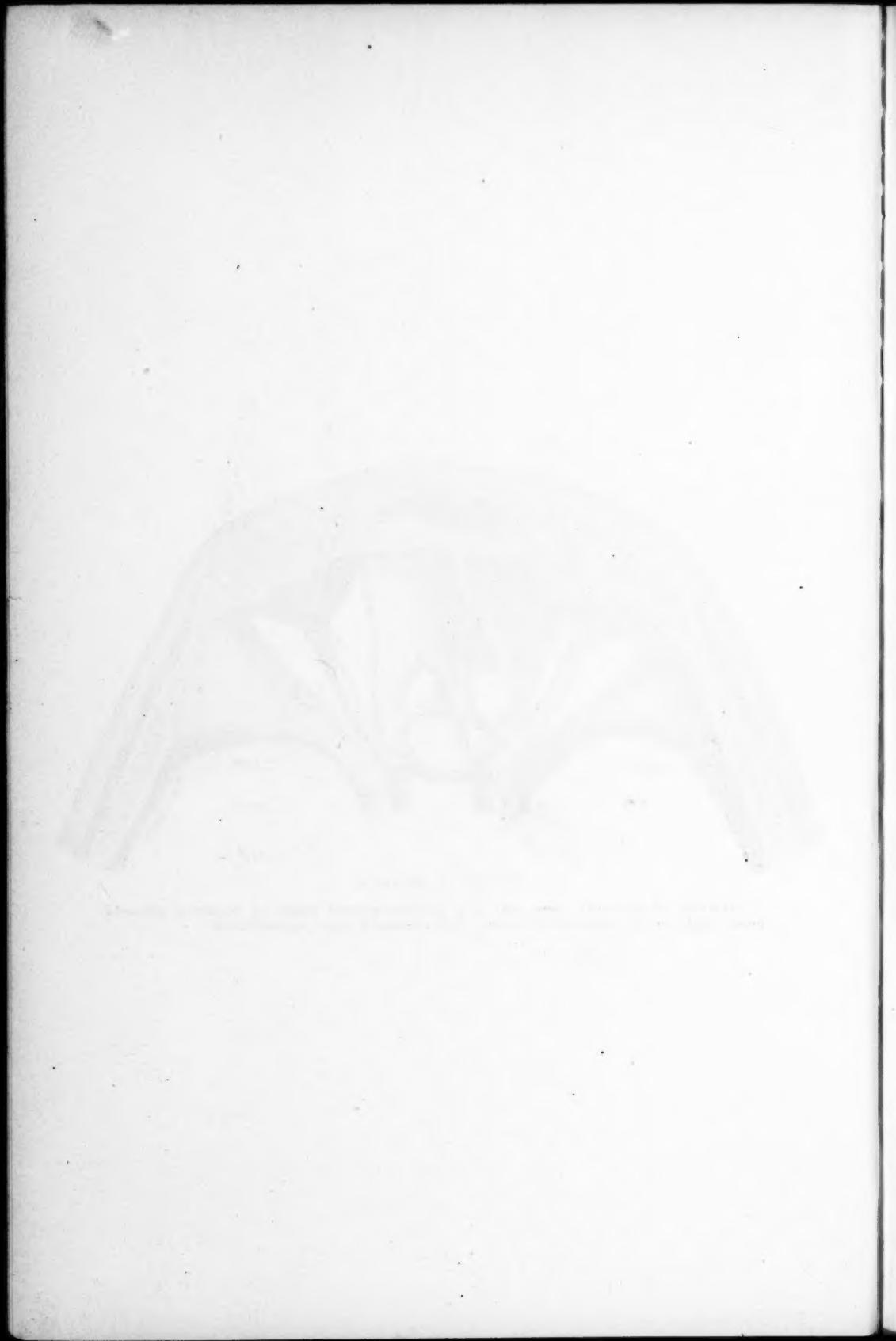


FIGURE 5. HEAD X.

Relation of sphenoid (sss, ssd) and postero-external angle of posterior ethmoid (ceps, cepd) to the optic nerve shown; dnf, unusually high infundibulum.



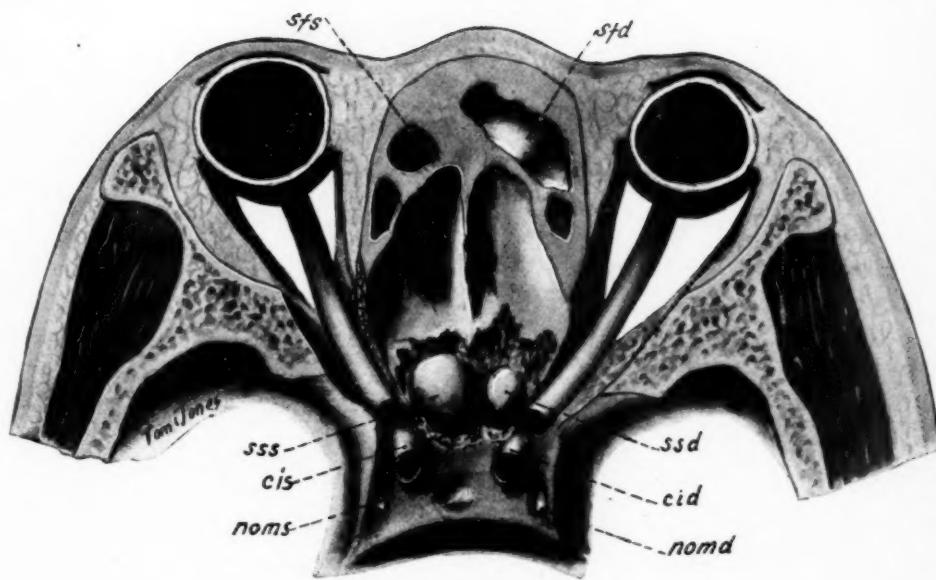


FIGURE 6. HEAD XI.

ssa, mucosa of left sphenoid; ssd, mucosa of right sphenoid; cis, cid, internal carotid; noms, nomd, motor oculi nerves.

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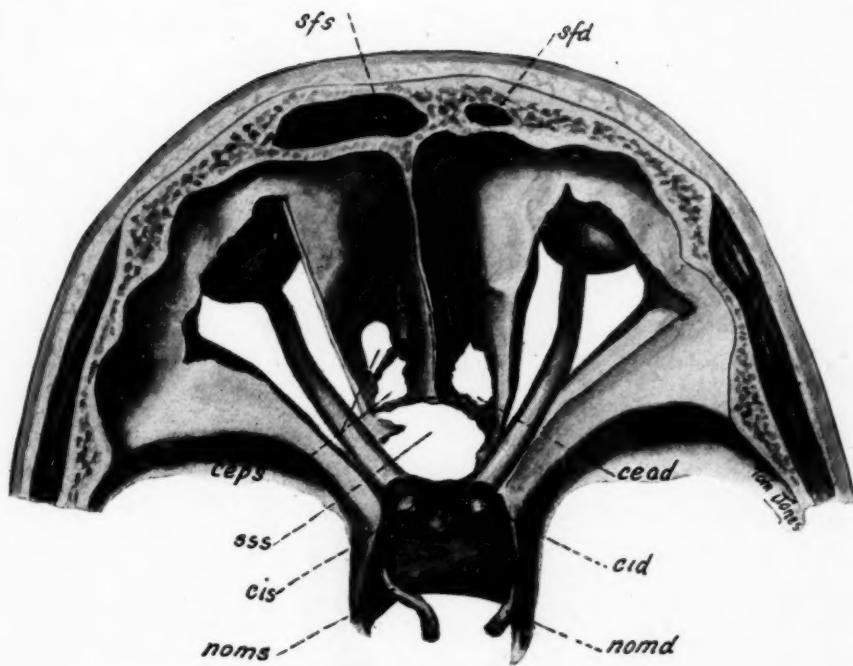


FIGURE 7. HEAD XII.

sss, left sphenoid in relation with optic nerve and chiasm; ceps, left posterior ethmoid cells showing relation with optic nerve at postero-external angle; cead, right anterior ethmoid showing similar relation; cis, cid, internal carotids; nomd, motor oculi nerves.

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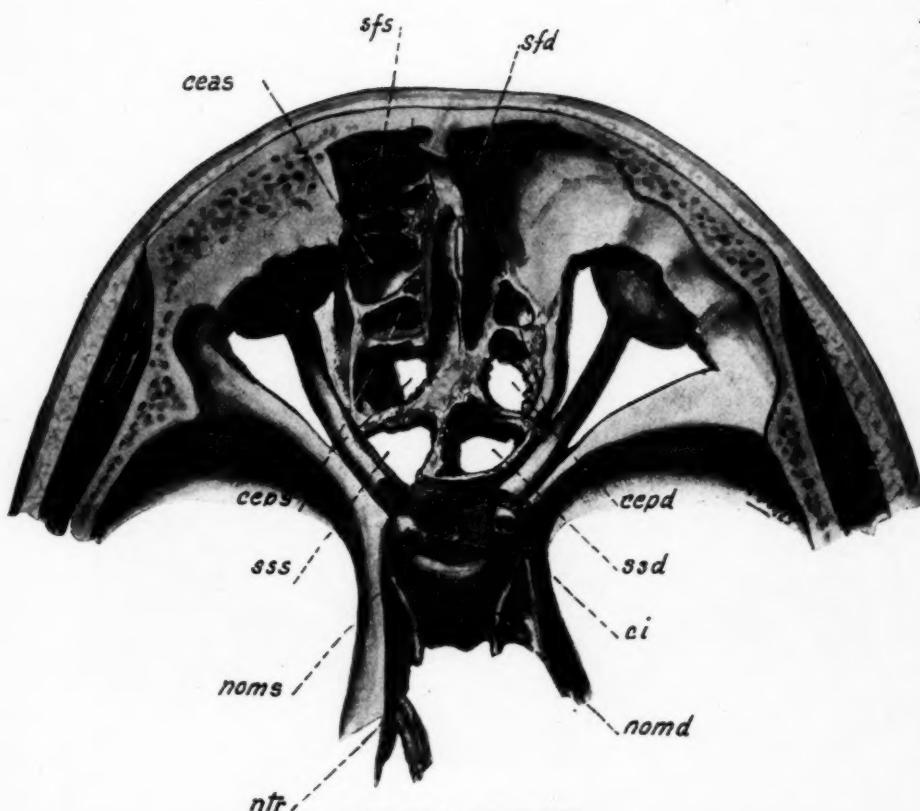
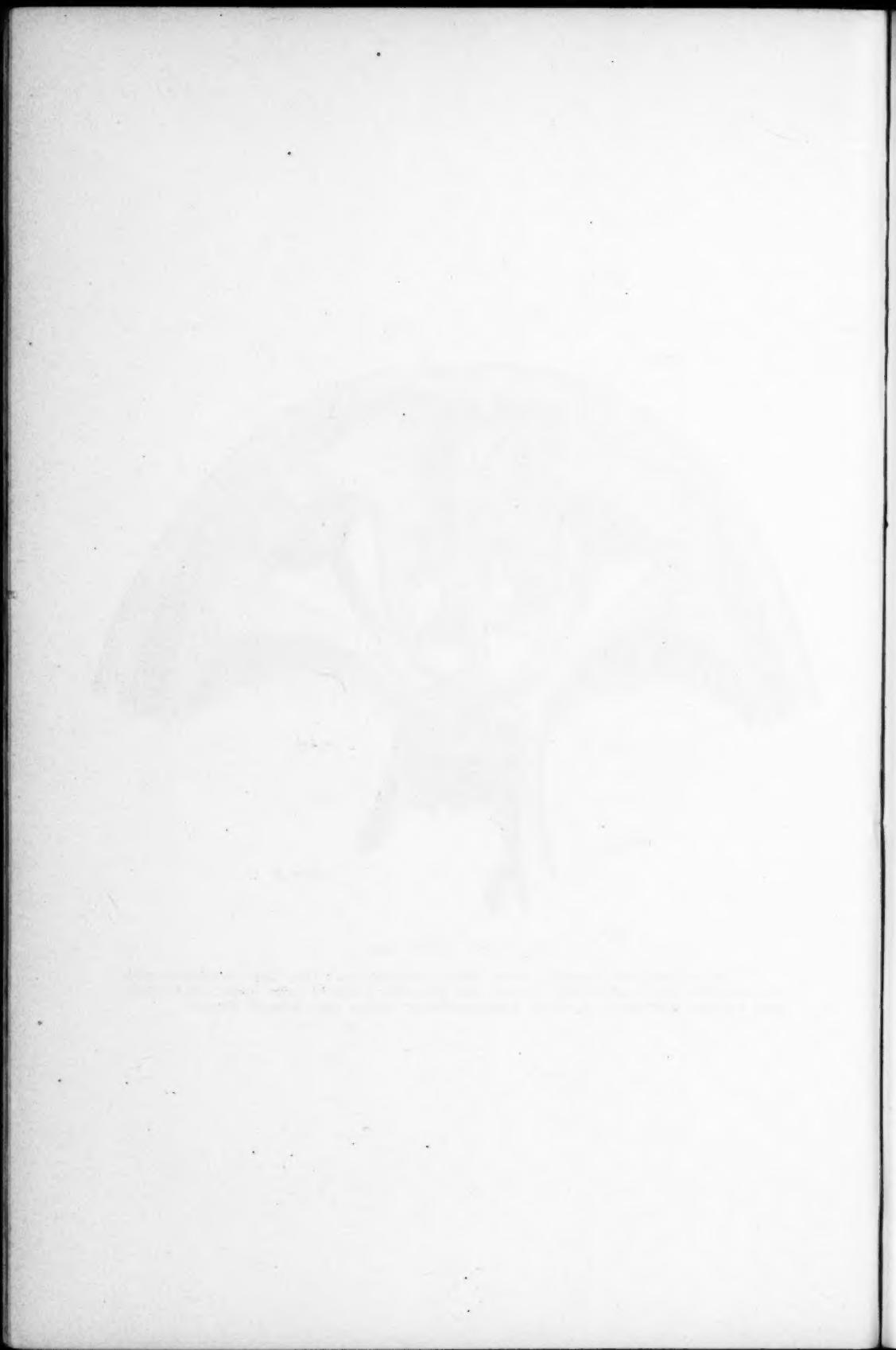


FIGURE 8. HEAD XIII.

Whole left labyrinth exposed (ceps, ceas); each sphenoid (sss, ssd) in relation with corresponding optic nerve and chiasm; last posterior ethmoidal cells (ceps, cepd) show usual relation with optic nerve at postero-external angle; ntr, trifacial nerve.



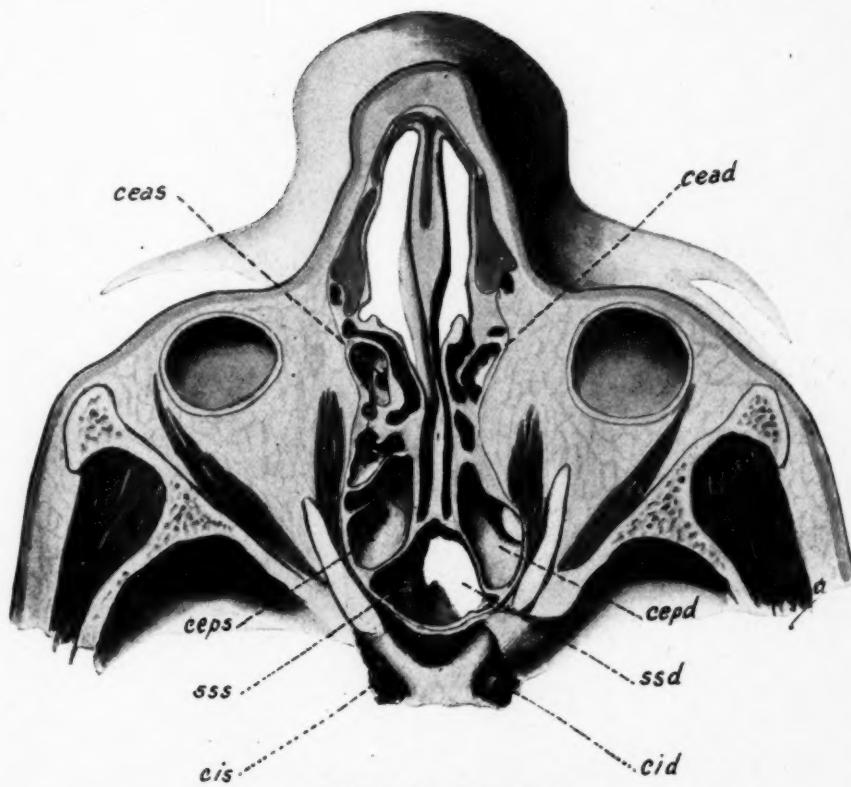


FIGURE 9. HEAD XIV.

Right sphenoid (ssd), in relation with both optic nerves and chiasm; left sphenoid (sss) is seen bulging into the right sphenoid; posterior ethmoid cells (ceps, cepd) show relation of optic nerves to cells at postero-external angle; ceas, cead, anterior ethmoid cells; cis, cid, internal carotid.

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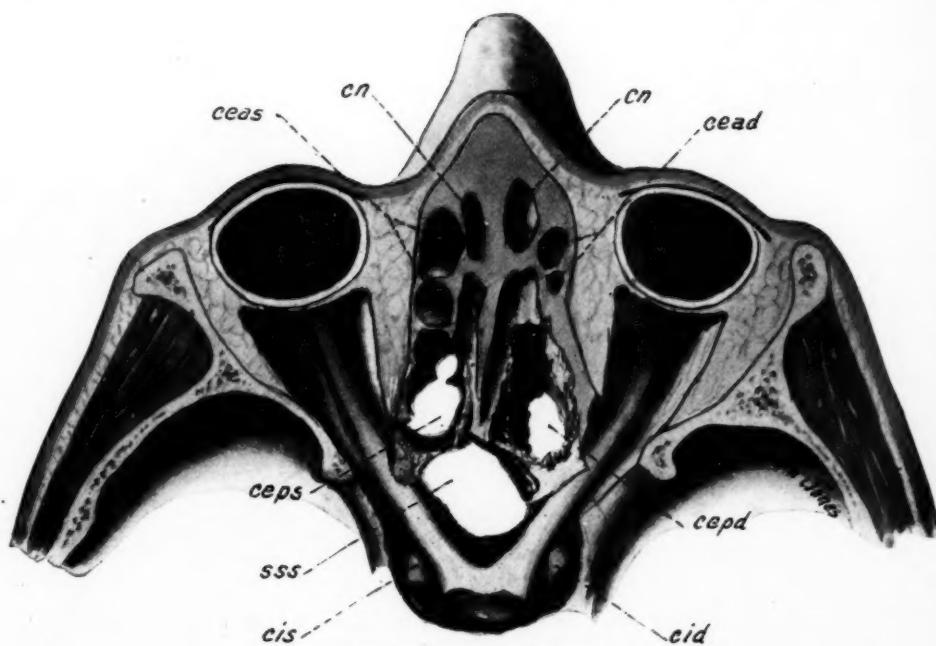


FIGURE 10. HEAD XV.

Left sphenoid (sss), in relation with both optic nerves and chiasm; posterior ethmoid cells (ceps, cepd), very large, both in relation with optic nerves at postero-external angle; cn, roof of nose; ceas, cead, anterior ethmoid cells; cis, cid, internal carotid.

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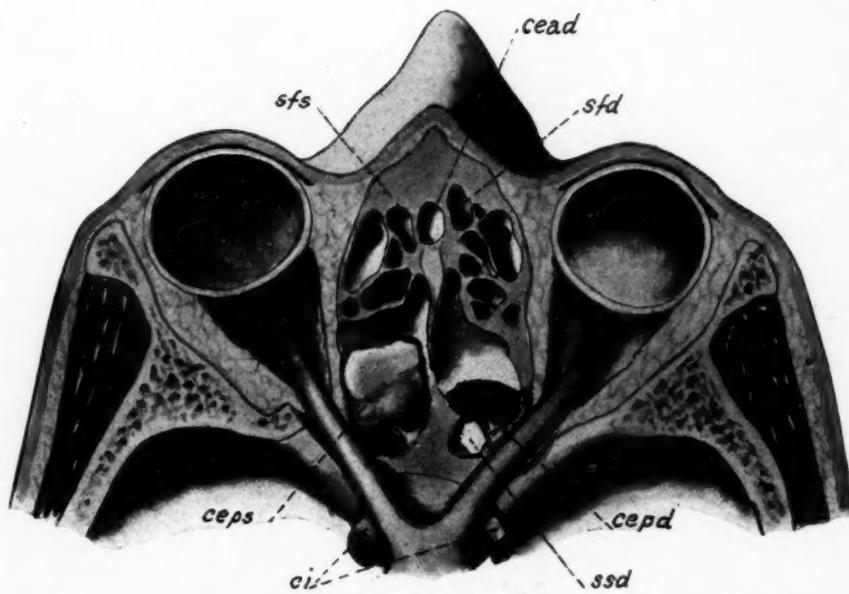


FIGURE 11. HEAD XVI.

Right sphenoid (ssd), in relation with right optic nerve but not with left optic nerve or chiasm. Left sphenoid does not reach the level of the section, being replaced by the posterior ethmoid, the mucosa of which is shown (ceps). The optic nerve passes along the external wall of this cell, which differs from the usual relation, shown on the right side (cepd), where the optic nerve runs along the postero-external angle of the cell; cead, right anterior ethmoid cell; sfs, sfd, frontal; ci, internal carotid.

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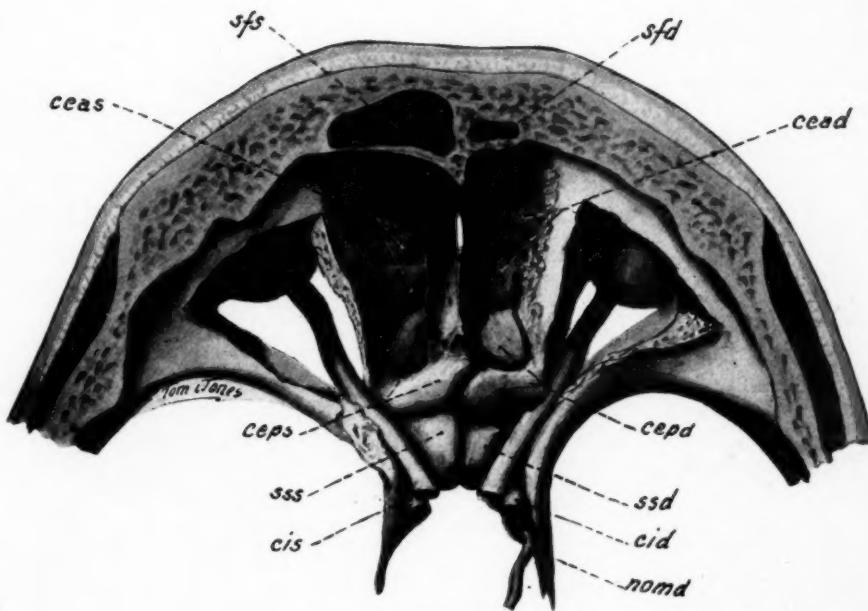


FIGURE 12. HEAD XVII.

The bony covering of the roof of the sinuses has been removed, leaving the mucosa intact; both sphenoid sinuses (sss, ssd), quite uniform; posterior ethmoid cells (ceps, cepd), in relation with optic nerve at postero-external angle; sfs, sfd, frontal; cis, cid, internal carotid; nomd, right oculomotor nerve.

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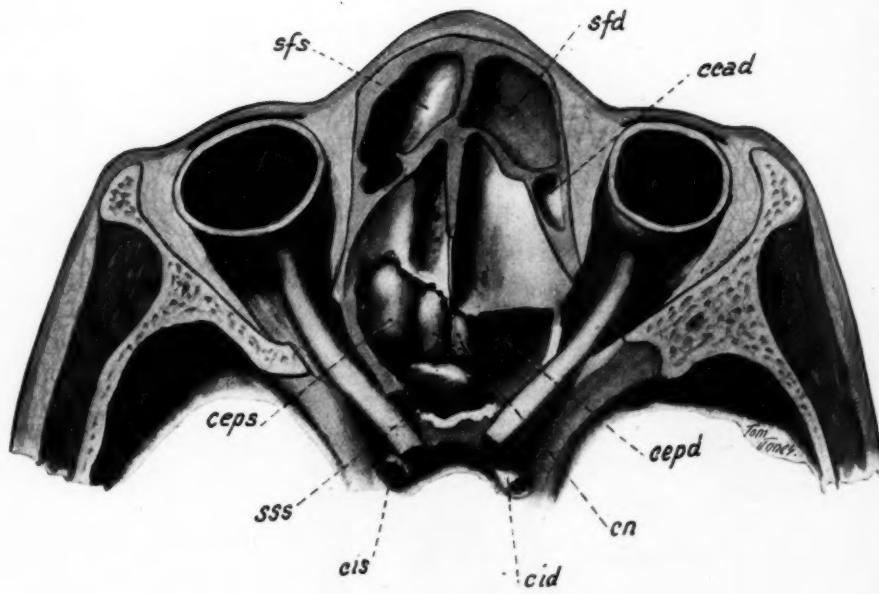


FIGURE 13. HEAD XVIII.

Left sphenoid (sss), in relation with optic nerves and chiasm; left posterior ethmoid (ceps), in relation with optic nerve at postero-external angle; right posterior ethmoid (cepd), replaces right sphenoid and optic nerve runs along its external wall; sfs, sfd, frontal; cn, mucosa of nasal roof; cis, cid, internal carotid; cead, right anterior ethmoid.

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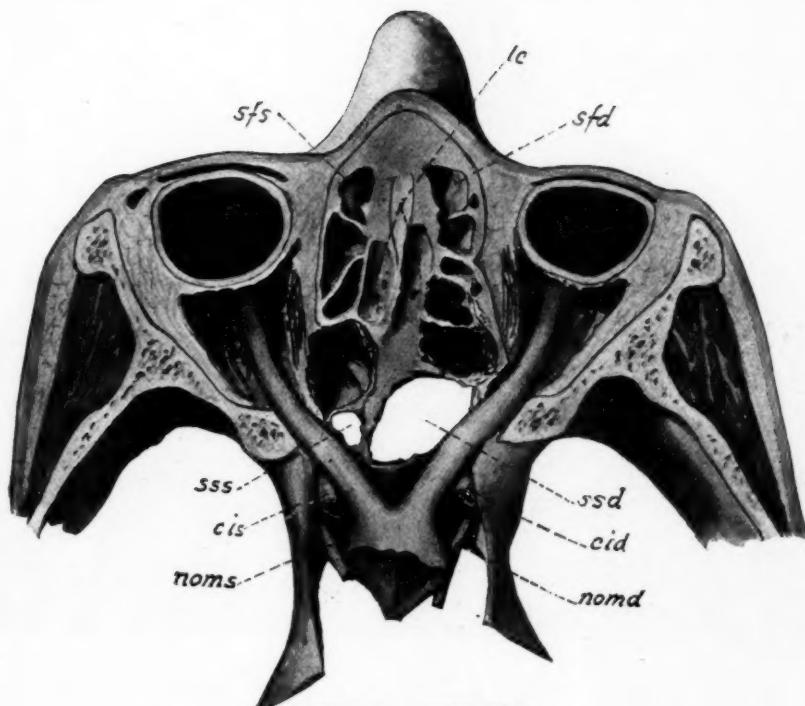


FIGURE 14. HEAD XIX.

Left sphenoid (sss) very small, in relation with left optic, but not with right; right sphenoid (ssd) in relation with both optic nerves and chiasm. Posterior ethmoid cells (ceps, cepd) in relation with optic nerves at postero-external angle; l. c., cribriform plate; sfs, sfd, frontal sinus; cis, cid, internal carotid; noms, nomd, oculomotor nerves.

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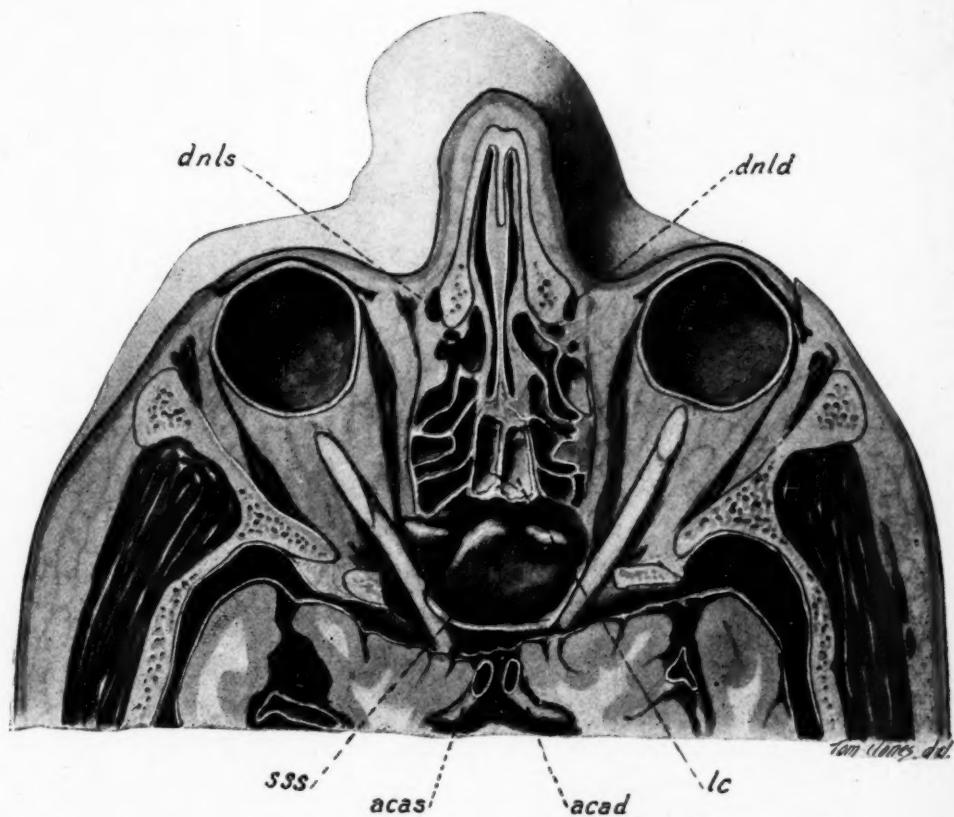


FIGURE 15. HEAD XX.

**Left sphenoid (sss),** with mucosa of roof intact, in relation with both optic nerves and chiasm; posterior ethmoid cells on either side of anterior projection of sphenoid in relation with optic nerve at postero-external angle, near the roof; acas, acad, anterior cerebral arteries; dnls, dnld, nasolacrimal duct; lc, cribriform plate.

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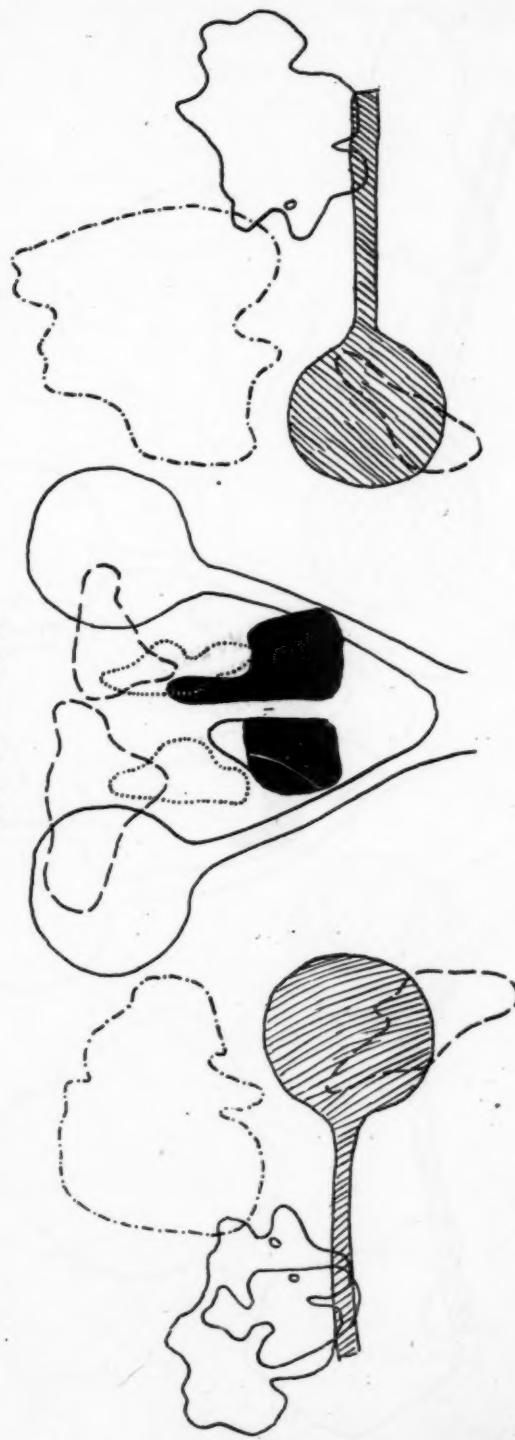
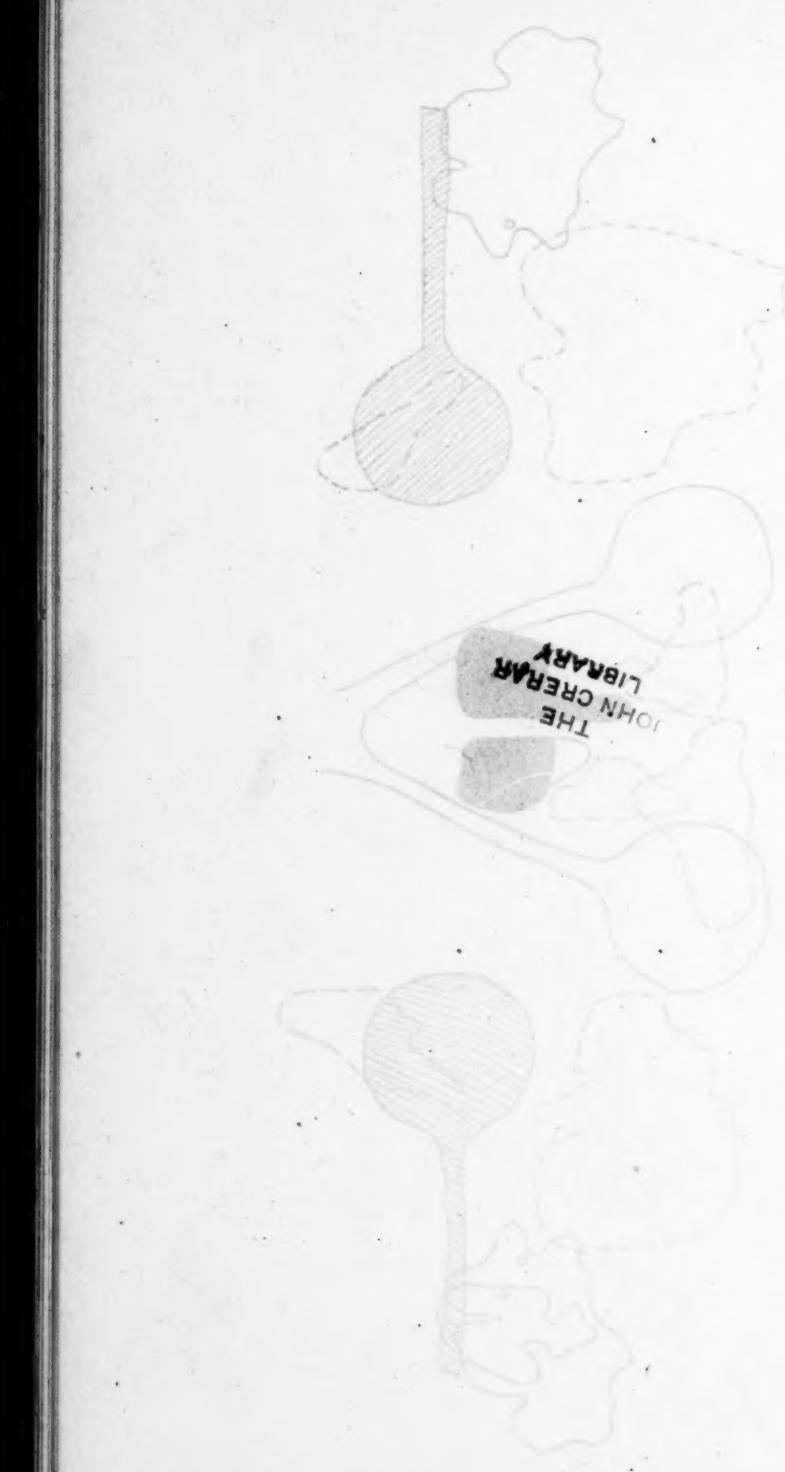


FIGURE 16. HEAD VI.

Right sphenoid in relation with left optic as well as right optic. Left sphenoid much smaller than right. Last posterior ethmoid on both sides in relation with optic nerve at postero-external angle. Two such cells on the left side. In this and the succeeding illustrations, the lateral reconstructions (at each side) show the frontal in parted lines, the sphenoid in solid lines, the maxillary in parted lines with a dot between each division; the superior reconstructions (in the middle) show the frontal in parted lines, the anterior ethmoid in dotted lines, the posterior ethmoid in solid lines, that part of the ethmoid in relation with the optic nerve being made black. The optic nerves, globe and chiasm are obvious. All drawings are natural size.



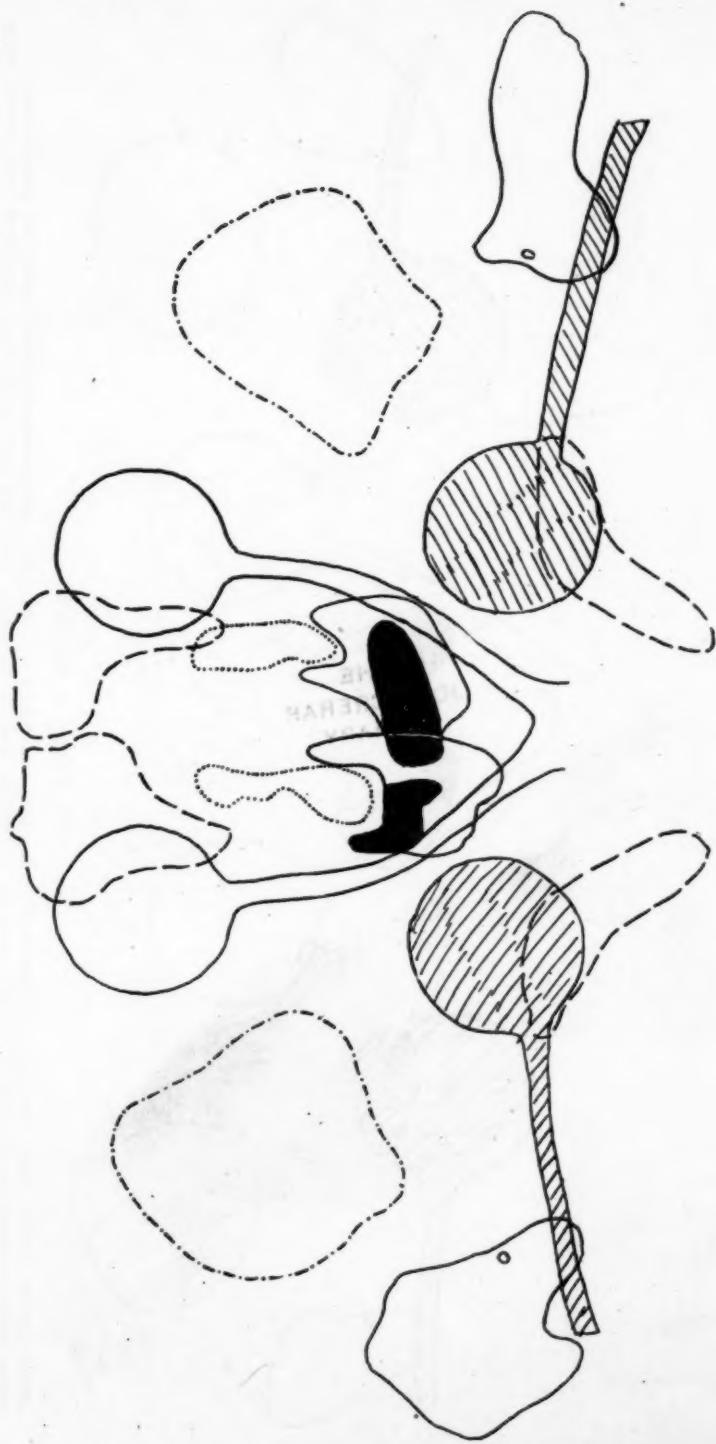


FIGURE 17. HEAD VII.

Both sphenoids extend far behind optic chiasm which lies on their roofs. Notice great difference in their shape. Last posterior ethmoid cells show usual angular relation to optic nerve.



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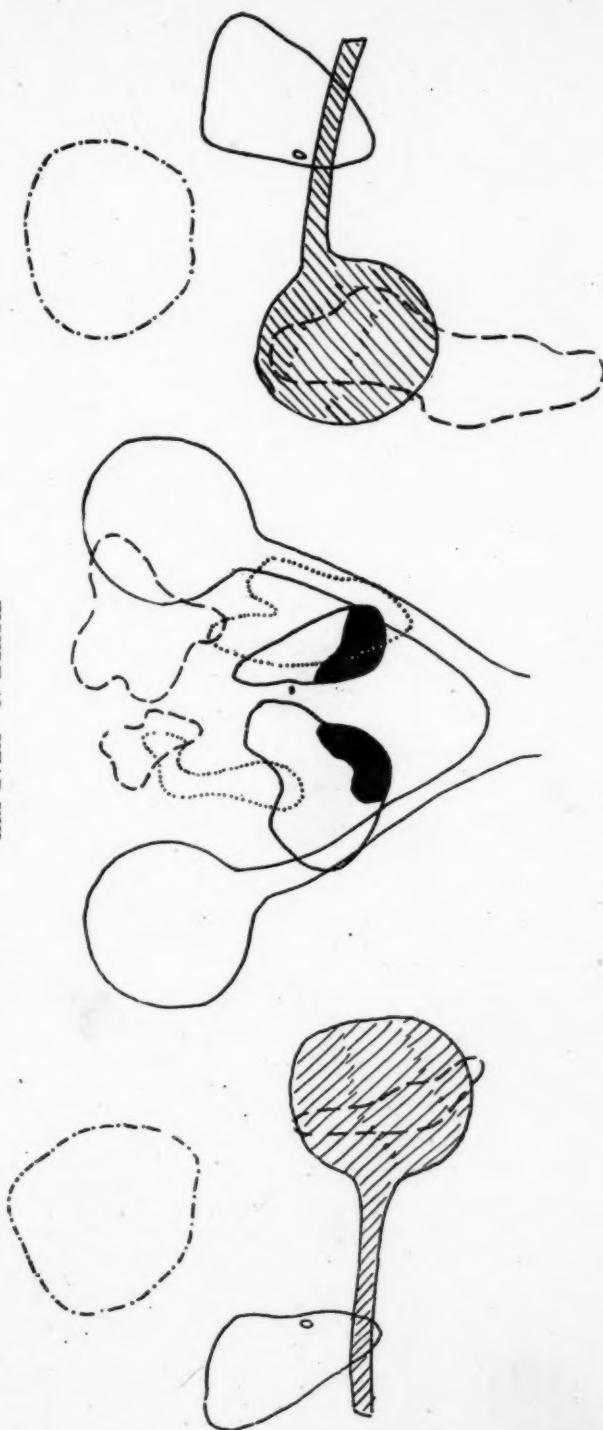


FIGURE 18. HEAD VIII.

Optic chiasm lies behind both sphenoid sinuses, which are fairly uniform. Nasal orifice of right sphenoid very close to level of optic nerve. Right frontal very extensive, much larger than left. Last posterior ethmoid cells show the usual relation to the optic, at postero-external angle. Right anterior ethmoid extends behind the posterior but not at the level of the optic.



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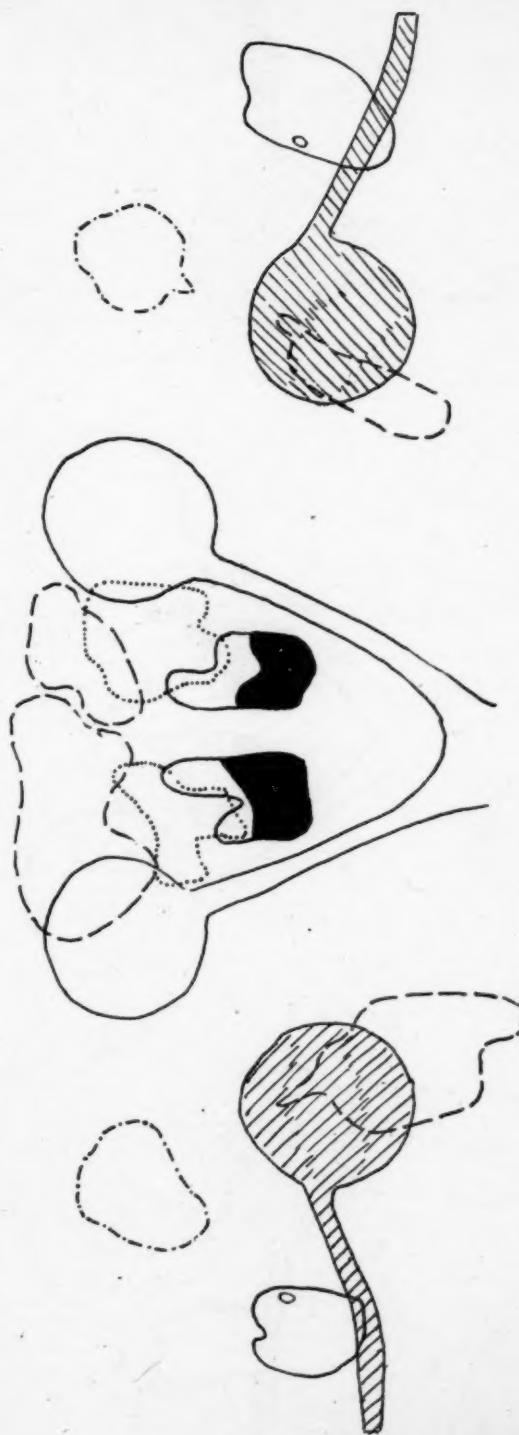


FIGURE 19. HEAD IX.

Sinuses all small except left frontal. Chiasm above and behind both sphenoid sinuses. Nasal orifice of left sphenoid near the floor of the sinus. Last posterior ethmoid cells in relation with optic nerve at postero-external angle of the cell.

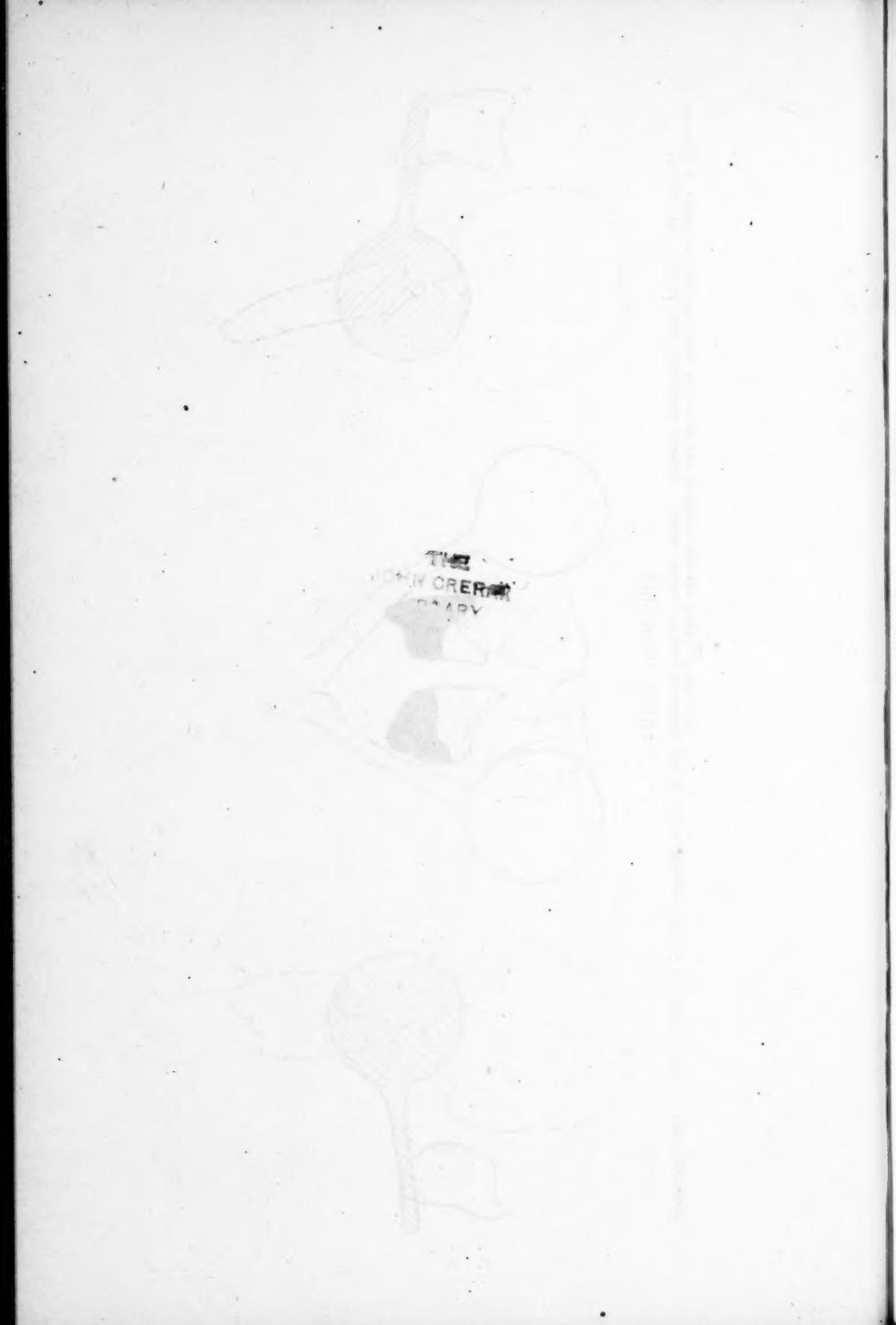


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FIGURE 20. HEAD X.

Chiasm lies behind both sphenoid sinuses. Nasal orifice of the sphenoid but a short distance below the optic nerve. Last posterior ethmoid in relation with the optic nerve at the postero-external angle of the cell.



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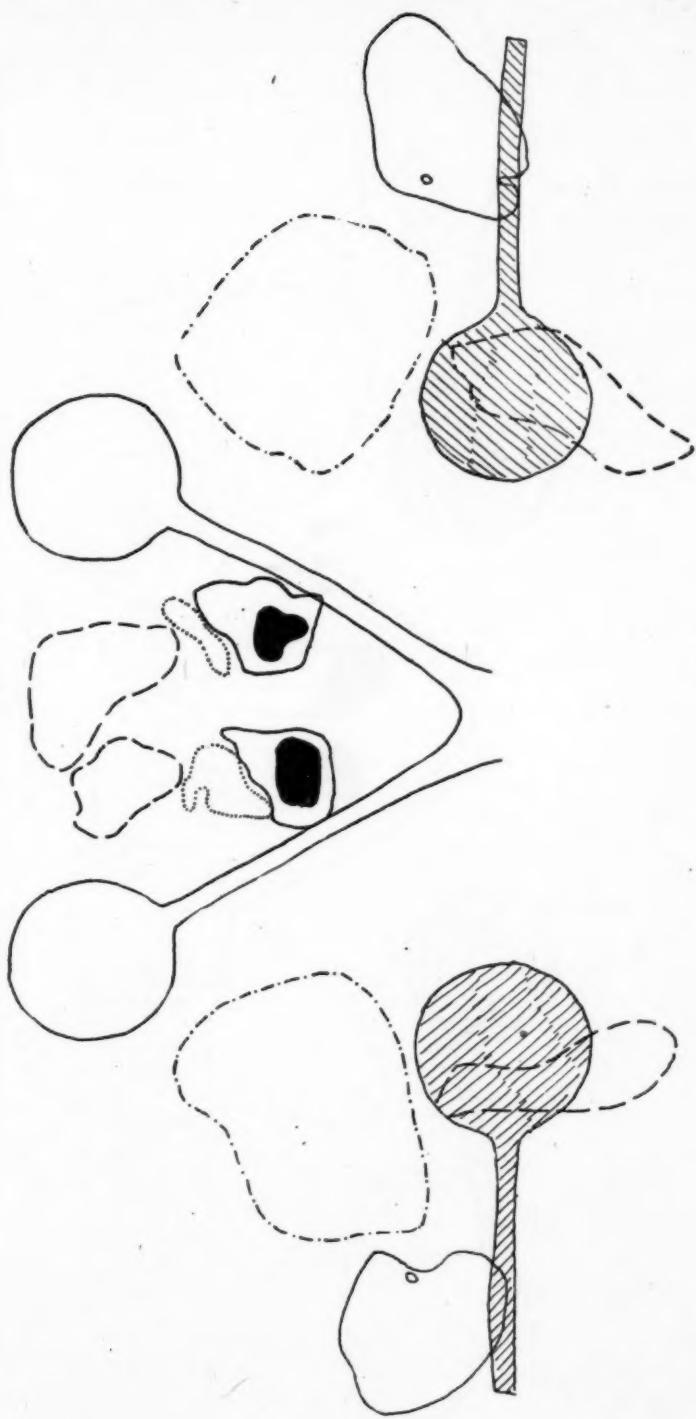


FIGURE 21. HEAD XI.

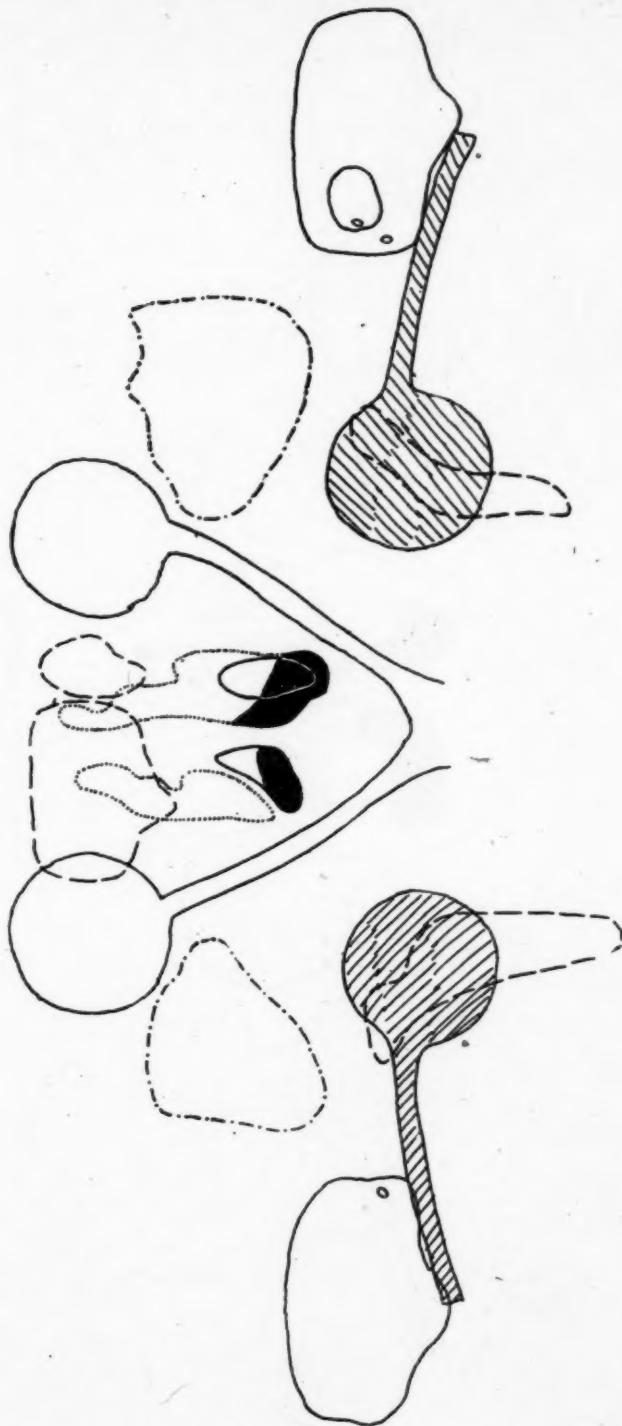
Both sphenoid sinuses large, clausum above their roofs and behind the greater portion. Last posterior ethmoid cells in relation with optic nerves at postero-external angle.



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FIGURE 22. HEAD XII.

Right sphenoid very small, not in relation with optic nerve or chiasm. Left sphenoid in relation with both optic nerves. Nasal orifice of this sinus near both optic nerves. Optic chiasm lies wholly on root of left sphenoid. Last left posterior ethmoid in relation with optic at postero-external angle. Right anterior ethmoid cell replaces small posterior ethmoid and is in relation with the optic at its postero-external angle.





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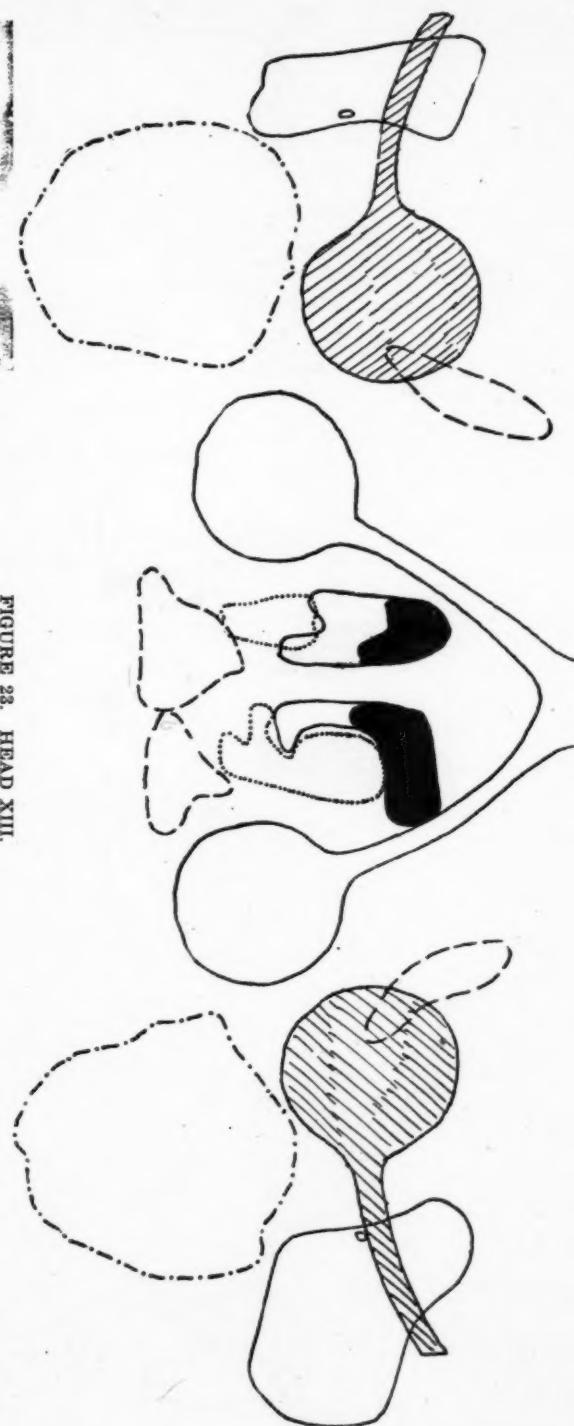


FIGURE 23. HEAD XIII.

Left sphenoid very large, right as large in a supero-inferior direction but smaller antero-posteriorly. Chiasm lies on roof of left sphenoid and behind the posterior wall of the right sphenoid. Orifice of the left sphenoid just below the optic, distance slightly greater on the right. Last posterior ethmoid cells in relation with optic at postero-external angle. Both frontals very small.



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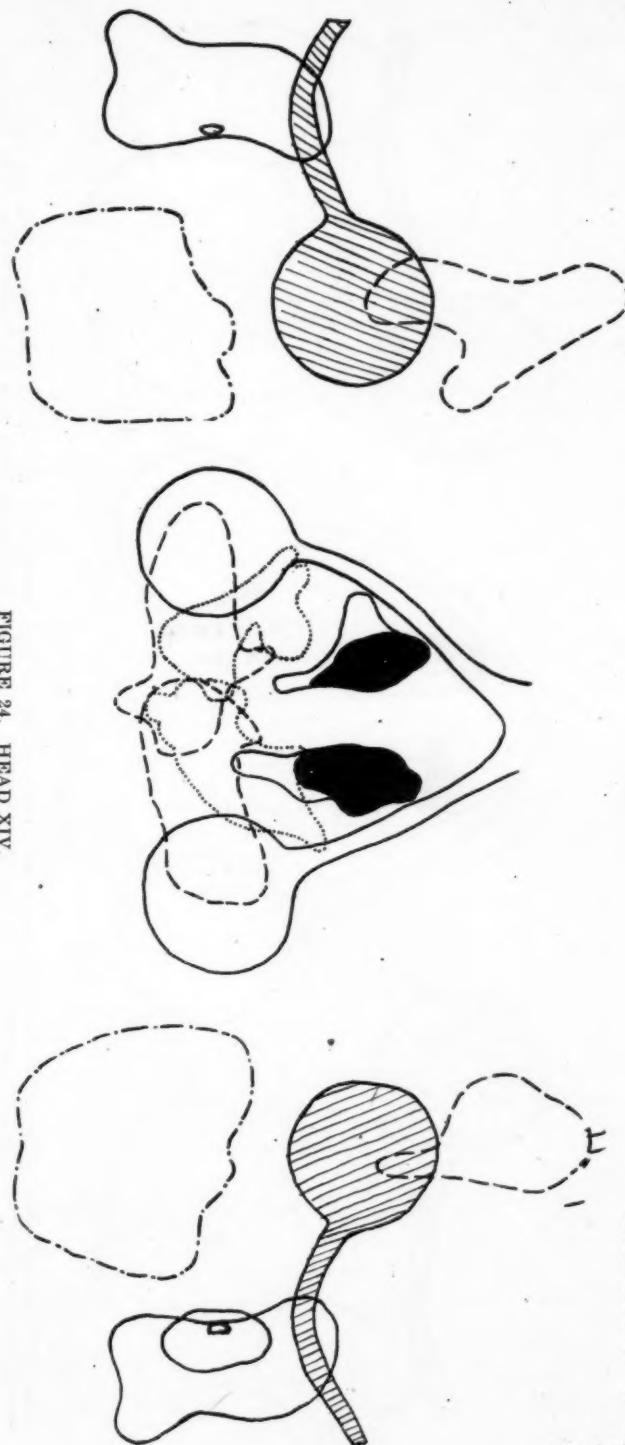


FIGURE 24. HEAD XIV.

All sinuses except the left sphenoid large. Left sphenoid not in relation with optic, right in relation with both optic nerves. Chiasm lies behind right sphenoid. Last posterior ethmoid cells in relation with optic nerves at postero-external angle.



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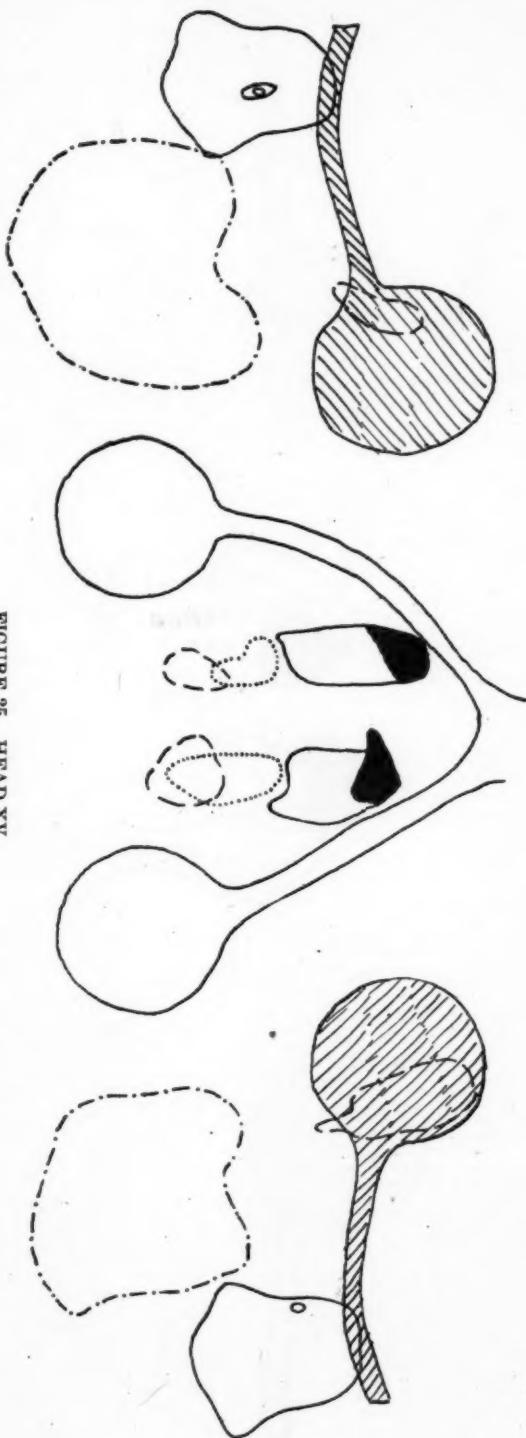


FIGURE 25. HEAD XV.

Right sphenoid insignificant in size, but little larger than its nasal orifice. Left sphenoid virtually takes up its space, coming into relation with both optic nerves superiorly and with the chiasm posteriorly. Posterior ethmoid cells in relation with optic nerves at postero-external angle. Frontal and anterior ethmoid cells very small.



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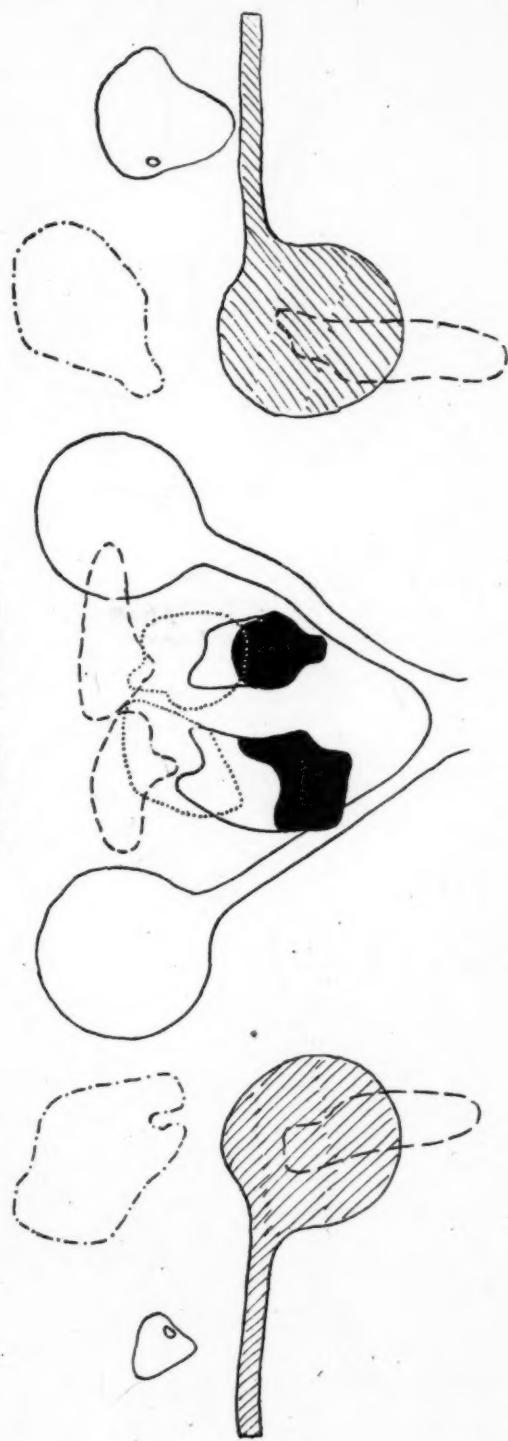


FIGURE 26. HEAD XVI.

Left sphenoid 10 mm. below optic nerve, right much nearer. Chiasma lies behind the posterior wall of right sphenoid and above the root of the left. Left posterior ethmoid, having replaced left sphenoid, has a more extensive relation than usual with the optic nerve, viz., along its external wall. Right posterior ethmoid has usual relation at postero-external angle.



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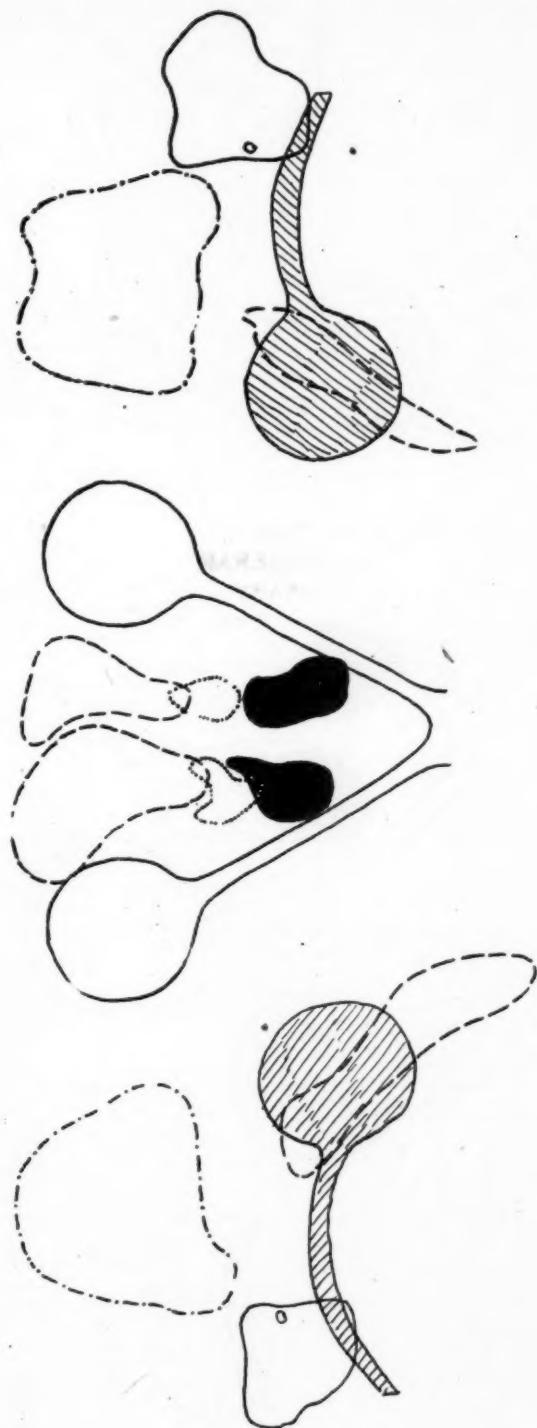


FIGURE 27. HEAD XVII.

Sinuses unusually uniform. Chiasm above and behind the sphenoid sinuses. Nasal orifice of right sphenoid nearer the optic nerve than that of left. Usual angular relation of posterior ethmoid cell to optic nerve on both sides.



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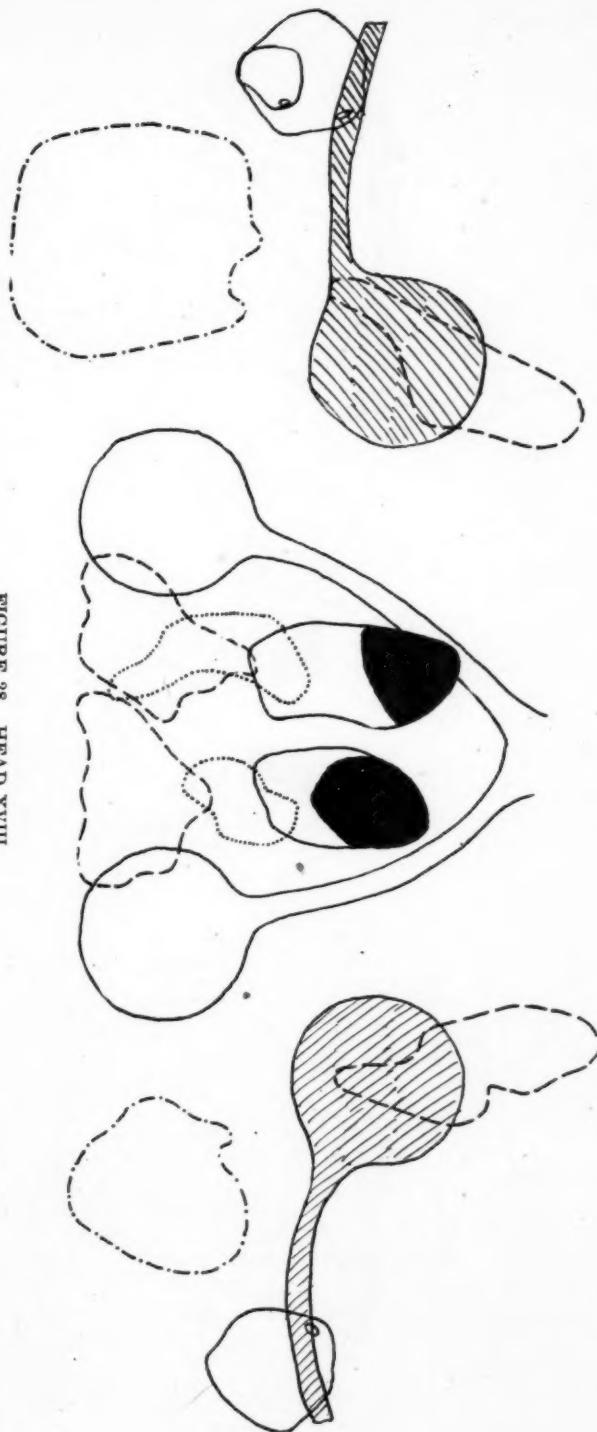
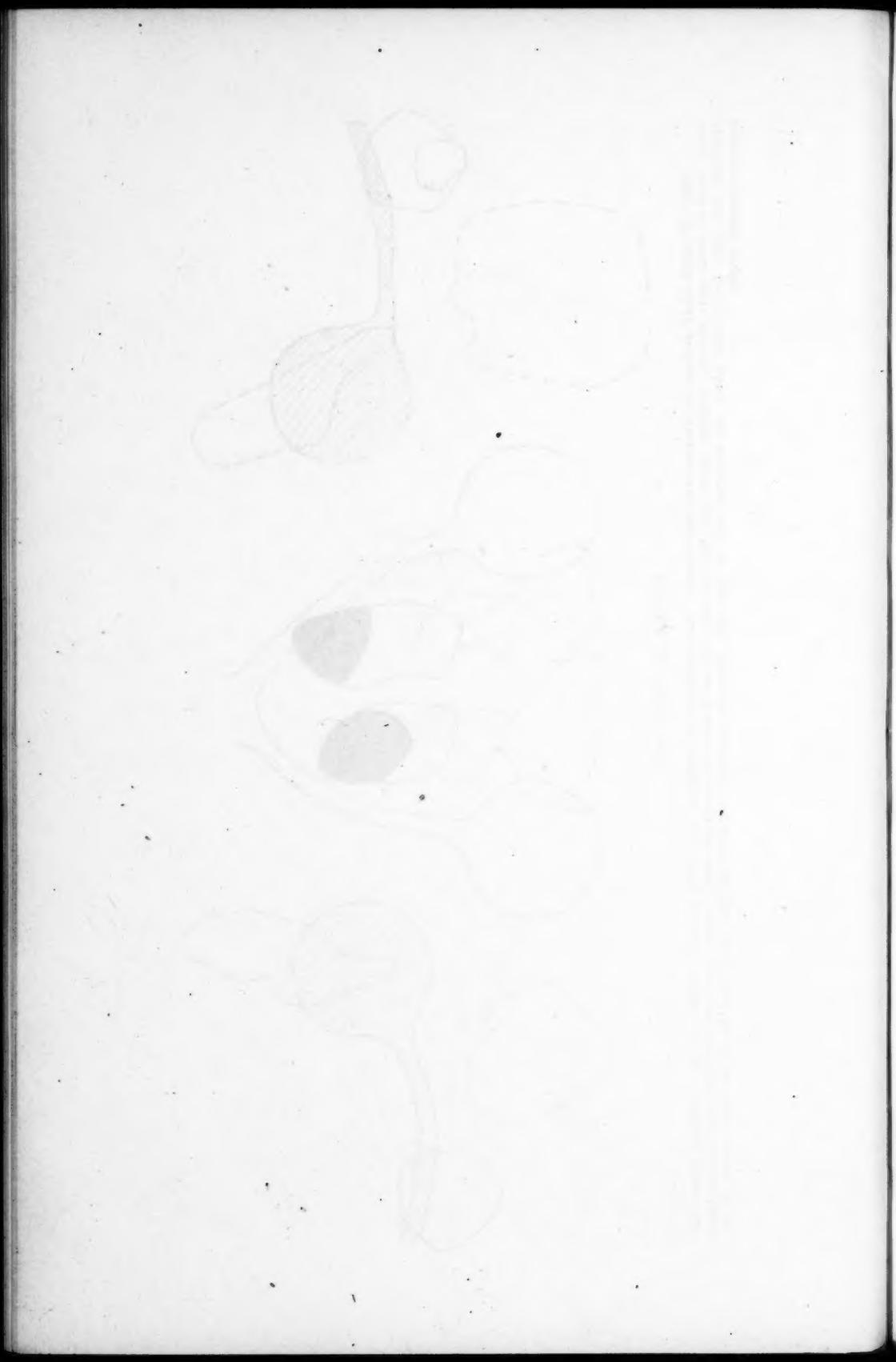


FIGURE 28. HEAD XVIII.

Right sphenoid small and not in relation with optic nerve. Left sphenoid in relation with both nerves. Orifice of left sphenoid above the lower level of both optic nerves. Chiasm above the root of right sphenoid near the posterior wall. Right posterior ethmoid cell replaces right sphenoid and optic nerve runs along the external wall of the cell. The left posterior ethmoid has the usual relation of the optic nerve, at the postero-external angle.



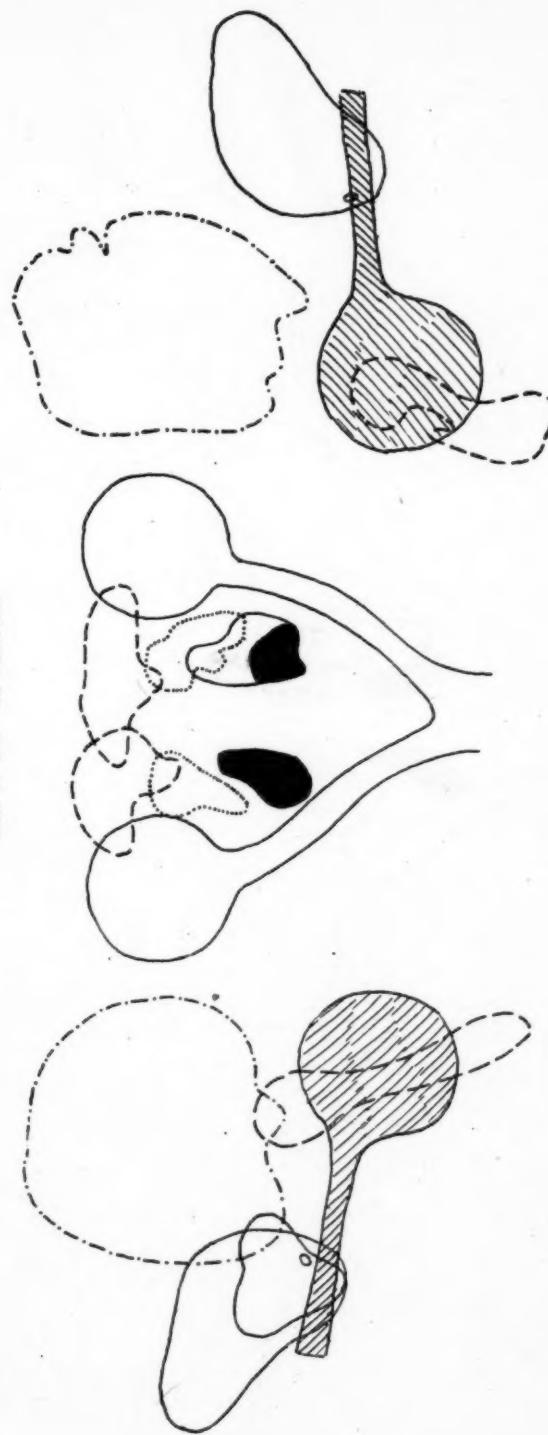


FIGURE 29. HEAD XIX.

Right sphenoid large, in relation with both optic nerves. Left sphenoid much smaller, in relation with the left optic only. Optic chiasm lies on roof of right sphenoid which extends a considerable distance posteriorly. Orifices of both sphenoids lie practically at the level of the optic nerve. Both posterior ethmoid cells in relation with the optic at their postero-external angle.



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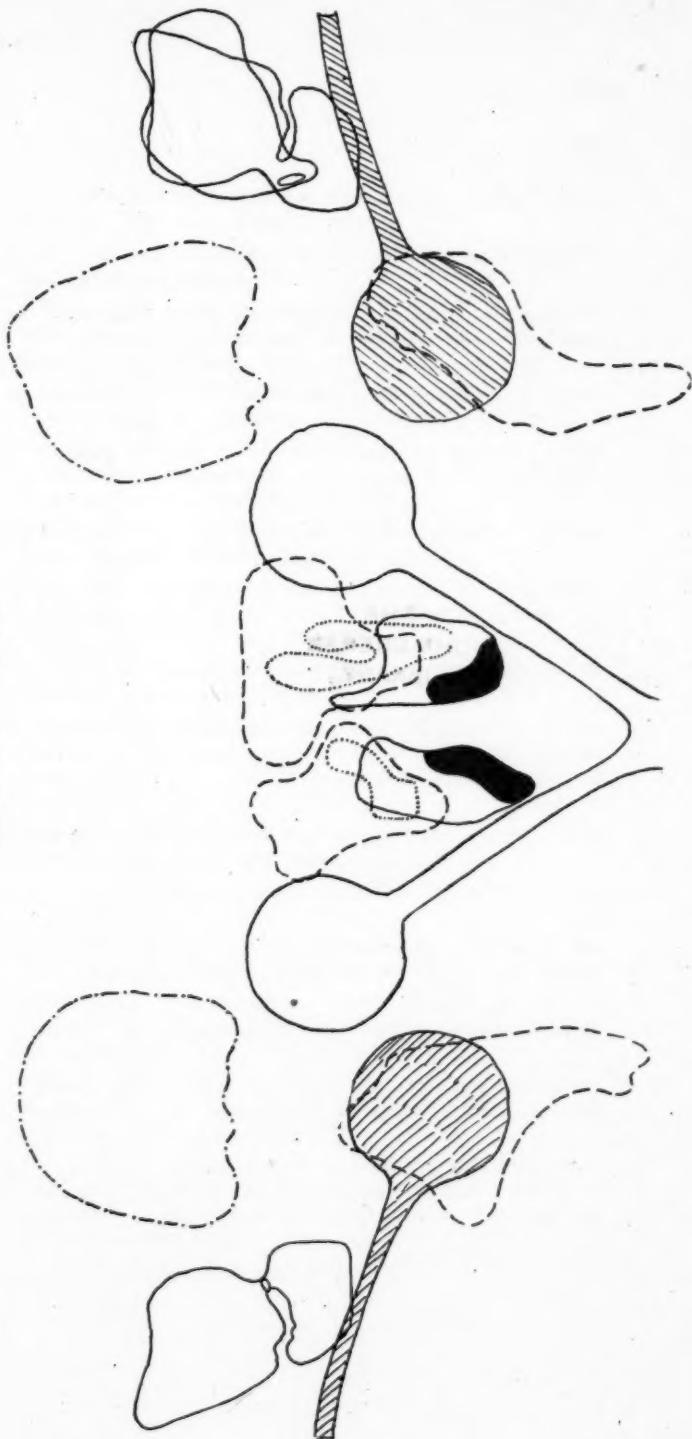


FIGURE 30. HEAD XX.

Left sphenoid peculiar in shape, in relation with both optic nerves. Right sphenoid though quite large not in relation with either nerve. Chiasm lies behind the left sphenoid. Both posterior ethmoid cells in relation with optic at postero-external angle.



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XXII.

DISEASES OF THE EYE AND ORBIT SECONDARY  
TO PATHOLOGIC CHANGES IN THE NOSE  
AND ACCESSORY SINUSES.\*

BY CHRISTIAN R. HOLMES, M. D.,

CINCINNATI.

Of late years the attention of many of the best minds among the rhinologists of Europe and America has been turned to the relationship that exists between the diseases of the nose and its accessory cavities and the resulting secondary affections of the orbit and the eye. The volume of literature upon the subject is large and is constantly growing and the industry of observers everywhere is an index and an evidence that the new pathology offered at once a key to a numerically important and a clinically obscure class of cases that previously were of doubtful prognosis as to function and even as to life itself.

The scientific study of these problems began with the discovery of the locally anesthetic properties of cocaine by Dr. Carl Koller. Previous to that date we find a long list of reported cases of osteomata, benign or malignant soft growths and inflammations involving the sinuses and the eyes and adnexae, but they were only dealt with surgically when they had assumed such proportions that they had become unbearable to the patient or a source of reproach to the surgeon. Many of us have seen—and it does not seem so long ago—that an exophthalmos, accompanied by pain, tenderness and fever would be treated by the expectant method by very competent men, or, if the abscess pointed in the region of the upper or lower lid, that a bistoury would be cautiously plunged into it, evacuating the pus from the orbit while no attempt would be made to attack the primary focus of the disease, the operator not realizing that this lay in one of the accessory sinuses.

\*Read before the Eastern Section of the A. L. R. and O. Society at Philadelphia, January 9, 1909.

Since the introduction of cocaine, however, we have acquired a number of other aids in arriving at a complete and satisfactory diagnosis. They are adrenalin, transillumination, radiography, and a large number of clinical descriptions and pathologic reports of the macroscopic and microscopic conditions of the parts and tissues, and the non-pathogenic and pathogenic flora found therein.

By the indispensable aid of these means, we are now enabled to write down a definite pathology and symptomatology and—what is of great importance—we are able to proceed from effect back to cause and in this way to procure a radical cure in cases where our elders had to be content with more or less of palliation.

Thus we find that a number of so-called neuralgias are reflex or referred pains, due to intranasal pressure upon terminal nerve filaments in the course of acute or subacute coryza, in the paroxysms of hay fever, etc.

Epiphora often results from temporary occlusion of the lower end of the lachrymal duct—and the indications are, therefore, for attention to the nasal mucosa or other structures. Probing or slitting of the ducts under such conditions is certainly never justifiable and should be resorted to only in chronic cases of long standing where repeated inflammatory processes have left behind them areas of fibrous stricture.

The phlyctenular keratitis so often associated with nasal inflammation in children responds much more readily to constitutional treatment associated with treatment of the nose than to treatment of the eye alone—in fact, the latter method is most frequently quite ineffective. I reported cases of this character some fifteen years ago and since then have frequently omitted all direct treatment of the eyes in my management of such cases. In all cases of conjunctivitis and keratitis, whatever the age of the patient, I make it a routine practice to treat the nose if inflamed and I am convinced that this joint treatment very materially hastens the cure in almost all, if not in all cases.

In this connection I would briefly refer to three typical cases from private practice:

Mrs. S., aged 65 years, had for two years suffered from repeated, severe attacks of phlyctenular conjunctivitis and keratitis, which never appeared to be influenced by the usual forms

of treatment. Recovery from one of these attacks was always prolonged and tedious. The slightest exposure would cause a return of the trouble and in the left eye useful vision was lost, because of maculae resulting from repeated corneal ulcerations. I had frequently examined the nose, but with the exception of a congestion and thickening of the membrane in general and over the middle turbinals in particular, there was nothing abnormal—transillumination was negative—the middle turbinates were, however, “wedged” in the rather narrow nares. During a violent recurrent attack, especially involving the good eye, I determined to remove the middle turbinates. The result was almost magical, and a permanent cure resulted without any other treatment. Repeated examinations after the operation failed to detect pus. Evidently the symptoms were caused by pressure resulting from a chronic hypertrophic interstitial inflammation of the mucous membrane, of the type we sometimes encounter in the middle ear.

CASE II.—Mr. W., aged 50. In 1896 this patient became totally blind in his left eye, after suffering from the most excruciating pains in the temple, occiput and back of the orbit for months at irregular intervals. There was no history of nasal catarrh and repeated examination failed to detect any. Having exhausted medicinal means of relief, I determined to open the left sphenoid cavity, and found it filled with pus (closed empyema). There was complete relief from pain and vision slowly returned to almost normal—a small central scotoma remaining as a result of too prolonged pressure upon the nerve; the delicate macular fibers having succumbed before the operation. For ten years after this operation the patient was entirely free from eye symptoms and head pains. Then began a burning sensation with mild catarrhal conjunctivitis of both eyes and asthenopic symptoms, which for a while he attributed to the fumes from paints and varnishes with which he worked. A vacation gave only temporary relief. He was compelled to spend his evenings sitting with his eyes closed in the darkest part of the room. Treatment of the lids and re-examination of his muscles and refraction failed to improve the trouble. After a year's treatment with others, he returned to me unimproved. With an increased knowledge of the intimate relation between the nose and eyes, I finally came to the conclusion that the cause was due to pressure within the nose. The left

sphenoid cavity, formerly infected, could be inspected through the opening made ten years before—and was found normal, but the middle turbinate bodies were "wedged." I operated upon both sides, with almost immediate relief. With the post-operative swelling there was a slight return of the eye symptoms, for about a week, but after the parts had healed the cure was complete and permanent.

CASE III.—Miss M., aged 32, one of my nurses, had for years been a great sufferer from head and eye pains, which became more frequent and severe. She felt incapacitated for work and contemplated giving up nursing and returning to her home in the country. Her nose had been examined repeatedly, but revealed no unusual amount of secretion and I did not think there were sufficient pathologic changes in the rather large middle turbinates to justify their removal. Only as a last resort did I consent. The relief was complete and permanent, with a marked increase in bodily weight and general well-being.

Inflammations of the orbit and of the deeper structures of the eye, involving the iris or all of the uveal tract, and optic nerve, are often secondary to inflammations of the nasal sinuses. On this relationship much has been written of late, both in this country and Europe; but here, as in other departments of medicine, we must guard against riding a hobby too hard, as I fear some of us may do in claiming too much etiologically for the nose and sinuses and overlooking many other important causative factors in other parts of the body, a mental obliquity that specialism is prone to lead us into unless we are on our guard.

The pathologic position of nasal polypi is now fixed as being a secondary manifestation of chronic purulent inflammation of one or more sinuses, and their recurrence after removal is sufficient evidence of the persistence of the empyema.

That their removal is not entirely free from danger, I have myself observed—especially when the galvanocautery or a caustic is used to destroy the base after the growth has been snared. This cauterization, in the light of our present knowledge, I hold to be most unsurgical, as it produces a more or less extensive sloughing surface affording refuge and pabulum to innumerable bacteria. A direct attack upon the sinus that is the seat of the inflammation is the only logical procedure.

Among the untoward effects of nasal cauterizations I have seen neuroretinitis, retinal hemorrhages and optic nerve atrophy—this latter result, as we now know, being due to a thrombosis following local infection.

There is one important subject that has not received the attention that it deserves—and I mention it here to bring it up for discussion: I refer to the nasal and orbital manifestation of syphilis.

The favorite seat of the orbital syphilitoma occurring in the course of nasal syphilis appears to be the superior orbital margin—and the first objective symptom is the appearance of a sharply circumscribed, hard, inelastic tumor, the overlying skin in the beginning not reddened. Later redness and fluctuation, going on to sloughing and evacuation of the characteristic tenaceous secretion—with rough, necrotic bone in the bottom of the abscess. The pain prior to the evacuation is very severe, but intermittent, as in most syphilitic periostitis. Antispecific treatment generally causes rapid and total resorption. The swelling of the orbital margin may cause displacement of the globe and interfere with its mobility. There may be involvement of the ocular muscles and if the inflammation extends to the apex of the orbit serious involvement of the optic nerve may occur with secondary atrophy. The displacement of the globe in these cases is not due to the presence of pus, but to a hyperplastic process taking place in the orbital periosteum and orbital fascia. Recognized in good time in a very large proportion of cases all of the swelling, even if extensive, may subside under energetic appropriate treatment without serious or permanent damage to important structures.

It is, of course, of great importance to differentiate between these gummata and malignant or non-malignant tumors. Failure to make correct diagnosis would possibly—even probably—lead to enucleation of an eye that ought to be and might be saved. The character and the amount of the pain is a valuable but not an infallible guide. The non-malignant tumors may cause great displacement of the globe with little or no pain—while in the gummata we practically always have the characteristic night pains of syphilis. No careful surgeon, however, would in a doubtful case appeal to operative measures without having applied the therapeutic test. The gummata may not spring from the orbital margin, but have their origin in the

middle cerebral fossa, involving the Gasserian ganglion with resulting trophic lesions—such as corneal ulcers, anesthesias, etc. Or the syphilitic growth may begin in the nose and extend to one of the sinuses and the orbit.

Double and symmetrical syphilitic orbital tumors are also encountered, and have been reported by Goldzieher and others. Schotts reported a fatal case in a child five years of age, where a gumma involved the nose, orbit and cranial fossa. Walter reported a fatal case in a child three and one-half years of age, the growth involving both orbits and intervening parts.

In both of these cases the diagnosis had been made of sarcoma, based upon microscopic findings of fragments of the tumors removed. Macroscopic and microscopic examinations after death proved them to be gummata.

Goldzieher's case was a girl, 16 years of age, with absolutely negative history. Tumors were removed from both orbits at different times—the microscopic examination resulting in a diagnosis of fibrosarcoma. The disease was not arrested by the operation—resulting in death. The postmortem revealed the process as having its origin in the bony walls of the orbit and adjoining sinuses.

Miliary gummata in liver, spleen and kidneys—postmortem and microscopic examination made by Prosector Minich (another had examined the tumors *intra vitam*) showed that it was a case of syphilitic gummata. To what extent these cases involved the sinuses is not shown by the reports. They were in the hands of ophthalmologists, who in all probability did not consider the accessory sinuses very seriously, as at that time the interrelation between the nose, the sinuses and the orbit had not been very generally recognized. Even the postmortem reports fail to mention the sinuses and I question if they were opened. There was no history of acquired syphilis in any of these cases of unrecognized congenital syphilis. In one of my own cases the microscopic findings were also incorrectly reported (and by a supposedly competent microscopist) and in view of the doubtful clinical picture and of the uncertainty of the laboratory reports I believe that the strongest possible weight should be given to the effects of antispecific treatment and that it should be pushed vigorously for a sufficient length of time to allow of its failure to definitely negative the diagnosis of syphilis.

Of the sinuses the antrum of Highmore was the first to claim the surgeon's' attention, being easy of access through the alveolus. Carious teeth no doubt pointed out the way. The literature upon diseases of this sinus is very extensive. In preparing a "bibliography of diseases of the accessory sinuses" from 1748 to date I have collected over 1500 references (and no doubt many have escaped me) to publications made before 1890. The vast majority of these referred to the antrum of Highmore.

While a number of cases of empyema of the antrum in infants with involvement of the lower lid and orbit have been reported, I doubt very much if most of them were not cases of osteomyelitis or necrosis with the formation of a pocket of pus, as in the young infant the antrum of Highmore is a mere slit instead of a cavity. I wish that some specially qualified American confrere would take up the study of the minute anatomy of the lining membranes of the sinuses in health and disease—paying especial attention to the lymphatics and blood supply, along the lines laid down by Dr. J. Marc André, as published in his excellent monograph "Lymphatiques du Nez," 1905.

The lining membrane of the antrum of Highmore being thicker and richer in glands and lymphatics and blood vessels than any of the other sinuses, gives it a high degree of resistance to unfavorable influences. This probably explains why this cavity can for years remain a receptacle for the pus flowing into it from the frontal sinus—as sometimes occurs—without the lining membrane of the antrum becoming diseased, as is proven by the fact that when the pus ceases to flow from the frontal sinus, after a successful operation, and the antrum is washed, the latter has repeatedly been known to remain normal without further treatment—a possibility we should bear in mind before resorting to the radical operation on this cavity. The extra thickness of the lining membrane also explains why we encounter in the antrum greater edema of its mucous membrane than in any of the other sinuses—this swelling is principally located in the loose connective tissue layer under the layer of ciliated epithelium. When the antrum is small this layer may swell to such proportions as to fill the cavity, producing intense neuralgia by pressure; the pain radiating to the orbit and eye. In chronic cases the lining

of the antrum may undergo fibroid changes forming septa and bands that almost occlude the cavity.

The relation between sinus disease and secondary involvement of the orbit and eye have recently been set forth in a masterly manner by Birch-Hirschfeld. So far as I have been instructed by my limited experience, my views and results coincide with his, and hence I have taken the liberty of translating his conclusions:

1. Sinus inflammation plays a much more important part in orbital inflammation than has been recognized up to date.

2. In nearly all cases we have to deal with an acute or chronic sinus empyema.

3. The extension of the inflammation to the orbit depends upon the local periostitis of the orbital wall, there being certain points of predilection. The infection usually follows the course of the perforating vessels.

4. The orbital inflammation may be a (1) periostitis, (2) orbital abscess, (3) diffuse orbital inflammatory infiltration.

5. The orbital periosteum often offers sufficient resistance to the inflammatory process to prevent its extension to the orbital contents and the abscess remaining subperiosteal may extend forwards, or backwards, into the orbit, causing an inflammation of the optic nerve; or if forward, evacuate itself spontaneously at the orbital margin.

6. In other cases the inflammation extends early to the orbital contents through a thrombophlebitis. These cases are more difficult to diagnose.

7. In addition to the circumscribed areas on the orbital walls tender to pressure, the direction of the dislocation of the globe is of diagnostic value.

8. Contraction of the visual field is rare.

9. Of great importance as an aid in the diagnosis of inflammation of one of the posterior sinuses (posterior ethmoid or sphenoid cavity) is the discovery of a central scotoma.

10. In 409 cases of orbital inflammation following sinus disease, 66 eyes became blind (16 per cent), blindness following most frequently empyema of the antrum of Highmore (27 per cent).

11. The ophthalmoscope *frequently* revealed hyperemia of the disc—optic neuritis—atrophy of the optic nerve *less frequently*. Thrombophlebitis of the retinal veins—retinal hemorrhage and detachment.

12. There were present *ulcus corneae* 18 times—panophthalmitis in 8 and glaucoma in 2 cases.

13. The mortality is highest in cases of empyema of the sphenoid (28 per cent of all fatal cases); in the frontal sinus empyema (16.3 per cent of the fatal cases).

14. Postmortem examination demonstrated:

Meningitis, 34 times.

Brain abscess, 15 times.

Sinus thrombosis, 6 times.

15. The author holds that the simple incision as made into the orbit by the ophthalmologists is inadequate and recommends free exposure of the orbital (bony) margin, with careful separation of the periosteum from the bone by means of a blunt periosteotome (using every care to protect the orbital contents). In this manner we obtain free drainage.

(To this I should add—to promptly establish thorough drainage from the affected sinuses, either by the intranasal or external operation. In cases where the orbital symptoms are not seriously threatening the functions of the eye, prompt drainage of the sinus will obviate the necessity of any operation upon the orbit, as I have several times demonstrated in my own cases.)

16. The examination and treatment of the nasal cavities and accessory cavities demand such training and experience as the ophthalmologist seldom possesses, and the writer feels that the diagnosis and treatment of sinusitis should be left to the rhinologist.

17. The importance of the ophthalmologist in these affections lies in the fact that he is often the first to establish the diagnosis, because these patients as a rule first seek relief from their eye symptoms, and in doubtful cases by a careful analysis of the ocular and orbital symptoms, he helps to arrive at a correct conclusion.

18. That from the working in unison of the ophthalmologist and rhinologist we may expect the development of the greatest amount of scientific knowledge and practical results.

In conclusion I wish to touch upon two points in relation to the diagnosis and operative management of suspected and also undoubted frontal sinus infection.

1. When the obscure clinical symptoms and somewhat negative findings of our diagnostic aids, such as the trans-

illuminator, have left us in doubt as to the condition of the sinus (and such a situation naturally precludes the presence of any very active inflammatory process) *we should not hesitate to make an external exploratory opening.* Since 1895 I have often resorted to this when in doubt—making a short incision just below the supraorbital margin above the inner canthus and exposing only enough bone to permit the removal of a disk 5 mm. in diameter by means of a hollow electric drill. If the sinus is healthy—then the wound is closed by catgut suture and hermetically sealed with gauze and collodion dressing. This latter left intact for two weeks. In another two weeks it is difficult to find the scar. I have never seen such a case fail to heal by first intention.

2. On account of its great importance, I wish to again call attention to the fact that we should not make minor intranasal operations within a period of several days before an extensive external operation in cases where we have to deal with a streptococcus infection, because of the liability to the erysipelatous infection of the skin wound. The minor intranasal operation is liable to excite the streptococci present to a high degree of virulence. While in this condition of exalted virulence infection of the external skin wound is more than likely and an erysipelatous inflammation starting in this neighborhood is extremely dangerous to the eye, if not, indeed, to life itself.

When during an acute frontal sinus inflammation it becomes absolutely necessary to give vent to pent-up pus, establish drainage through a small opening in the floor of the sinus, doing as little damage as possible to the skin and subcutaneous structures and postpone the radical operation upon and cure of the cause until the acuteness of the inflammation and the virulence of the streptococci have subsided.

XXIII.

ORBITAL COMPLICATIONS OF DISEASE OF THE  
FRONTAL SINUS.\*

By HOWARD F. HANSELL, M. D.,

PHILADELPHIA.

The subject chosen by Dr. Holmes for his essay and the discussion proposed by the president, Dr. Packard, are most opportune. Readers of recent ophthalmic literature must be impressed with the number and value of papers and clinical contributions dealing with the interrelationship of diseases of the accessory sinuses and diseases of the eye and orbit. The close anatomic connection existing between these cavities of the skull, separated only by perforated and attenuated bone from each other, and from the greatest of them all, is a sufficient reason for the frequency in association in disease, as of function in health. Moreover and independent of any precise and definite path, the coordination of function so easily unbalanced by imperfect control or failure of individual response, renders still more intimate and interdependent the combined physiologic action of the cavities and their contents. We have known since the early days of specialism that some ocular diseases, such as chronic conjunctivitis, corneal ulcer, dacryocystitis, may have their origin in pathologic conditions of the mucous membrane of the nose. Recently, owing to the valuable contributions of Zeigler, Posey, Germann, Axenfeld, Eversbusch, Gerber and Birch-Hirschfeld, we have awakened to the supreme importance of the etiologic connection in other and more dangerous ocular diseases. The investigations have been carried on by experts in both specialties and by pathologists, and as a result of their cleverness and industry we have at our disposal cumulative evidence of the greatest practical importance. I am sure that many of us may remember our treatment of patients, which, owing to our partial knowledge, was of

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little service. Had we fully appreciated the significance of symptoms and thought more deeply into the etiology and listened with greater patience to the story of the history, our opinions might have been more valuable. Early ignorance and neglect are all the more culpable in view of the quotation on the title page of Gerber's monograph, *Komplikationen der Stirnhöhlenentzündungen*, 1908, taken from *Med. u. Chir. Be-merk. 2 B.*, published in 1813. "Die Stirnhöhlen sind zuweilen der Sitz gefährlichen und schwer zu entdeckenden Krankheiten."

A conception of the frequency of orbital and ocular complications in accessory sinus disease may be learned from the statements of Birch-Hirschfeld (2nd ed. Graefe-Saemisch), "nearly all inflammations of the orbit are caused by empyema of the neighboring cavities," and of Mackay (Trans. Oph. Sect. Brit. Med. Asso., 1908), "evidence goes to prove not only that a large proportion, perhaps the majority of cases, of idiopathic orbital cellulitis and orbital abscess have their origin in diseases of the nasal accessory sinuses, but also that a considerable number of maladies affecting the textures of the eyeball and its appendages in a more solitary manner may at times be traced to the same source as direct or as reflex disturbances." The former writer says (*Klin. Monatsb. f. Augenh.*, January, 1908) that out of 684 cases of orbital inflammation, 409 (59%) were due to accessory sinus inflammation, and he suggests that the number would probably have been still higher if the nose and accessory sinuses had always been examined. In 129 (30%) the frontal sinus had been the starting point; in 89 (22%) the maxillary sinus, and in 25 (6%) the sphenoidal sinus. Gerber collected 177 cases of frontal sinus disease and 56% of them showed ocular or orbital symptoms. Accepting these figures as correct, the importance of the frequent coöperation of the laryngologist and ophthalmologist is demonstrated. Without expert examination of the frontal sinus the diagnosis in many cases must be doubtful. Only operation or postmortem will show the character and source of the disease. For example: A boy was admitted to the Jefferson Hospital (Trans. Sect. Ophthal. College of Physicians, Phila, 1908) who had received on the superior rim of the orbit an injury from a frozen snowball. On the day following the accident the lids were edematous, completely covering the ball, the con-

junctiva was chemotic and protruded between the lids, the eye was proptosed and immovable, the cornea rotated down and out, the media clear, the retina and nerve edematous. Operation showed fracture of the roof of the orbit and commencing purulent meningitis. The patient became delirious and died in three days. In this case it was clear we had to do with acute orbital cellulitis, but the complications and the structures affected could not have been positively foretold. The frontal sinus was not sufficiently developed to figure as a prominent factor in the diagnosis, and yet the presence of purulent inflammation following so speedily after the injury would suggest accessibility of germ-laden air.

Affections of the frontal sinus involve the orbit in one of three ways: by displacement of the structures, by infection, by functional disturbances.

1. Mechanical displacement or insult. Protrusion downward of the floor of the sinus by a collection of foreign matter in it will cause displacement of the orbital contents according to the degree and site of the swelling. The symptoms closely resemble those of an orbital tumor interposed between the eyeball and orbital roof. A man of 40 presented himself at the Eye Dispensary of the Jefferson Hospital in July, 1908, complaining of pain in the right orbit, diplopia, partial loss of vision and dislocation of the right eyeball downward and outward. He gave a history of two injuries to the right side of the forehead. The first occurred sixteen years ago by striking the top of a doorway while running. He was thrown down backward, but was not rendered unconscious. He had moderate pain for two weeks and lost one day's work. The second happened five years ago. As he was crossing a railroad track he tripped and struck the forehead and root of the nose against a rail. The wound was quite severe, requiring several stitches, of which he still bears the marks. A swelling could be felt between the ball and the superior margin of the orbit. Believing the growth was sarcoma, because of its slow growth, the pain, its rounded anterior extremity and its resemblance to other cases seen in the clinic which had proven to be tumors, the man was treated by application of x-rays. After two months' trial the only change consisted in the partial cessation of pain. Recently the pain returned with its former violence and the rays were ineffective. An ex-

ploratory incision was made and after carefully dissecting the tissues down to the supposed tumor, the enclosing sac of a large collection of pus was opened. After thorough evacuation of the pus a round perforation, 1 cm. in diameter, was found leading into the frontal sinus. In several places on the roof of the orbit as far back as the apex the bone was roughened as though denuded of periosteum. A rubber drainage tube was inserted and the wound sutured around it. In two days the tube was removed. The symptoms were relieved and gradually the eye returned to its normal position and regained its power of rotation. The patient complains of slight pain in the mornings, but is well the remainder of the day. A small electric light applied between the eye and the roof of the orbit gives much less reflex through the right than through the left half of the frontal sinus. Dr. D. Braden Kyle, who frequently examined the man, believes that the sinus is free from foreign contents and explains the dull reflex from the presence of inflammatory exudate of the old periostitis. The large and bright reflex of the left side indicates that the process was entirely limited to the right side and at no time invaded the left. The optic nerve and retina were not edematous, nor was the retinal circulation disturbed. The lowered vision was the result of several factors; pressure by the displaced orbital contents on the nerve between the ball and the optic foramen, the use of the periphery of the retina in the act of seeing, the foveal region having been displaced upward, hyperopia of 6 D. and amblyopia. The last examination was made January 6, 1909. Vision was only slightly improved by glass, the media were clear and the fundus healthy. It seems probable that the mucous membrane and periosteum of the frontal sinus will resume their normal condition and the perforation and the periostitis recover without further treatment. Had the exploratory incision not been made until after the pus sac ruptured, the ocular and orbital symptoms would have been more serious, to which would have been added the lively danger of extension backward of the infection to the meninges through the posterior orbital openings.

2. Infection. The pus invades the orbit directly through the perforated bone or is carried to the orbital tissues by the vessels. The causes of indirect infection are caries of the orbital roof, thrombophlebitis of the orbit, thrombosis of the

cavernous sinus, infection of the brain structures and transmission of the germ along the optic nerve sheath to the ball and to the muscles, lids and lacrimal apparatus.

3. Functional, in which there are no anatomical findings. Involvement of the eye and orbit is shown by accommodative and muscular asthenopia, limitation of fields, diminution of central vision and central scotoma. Under this head are included some of those obstinate cases of asthenopia which glasses will not cure. No lesion of the eye exists. The error of refraction may be small or great, spherical or astigmatic, perfectly corrected under mydriasis and the glasses intelligently worn. It may be that no symptoms point to the existence of sinus disease and attention is not called to the sinus as a possible source of the trouble, yet the oculist's duty is not fulfilled unless he eliminates the frontal sinus from the etiology.

The diseases of the orbit commonly associated with or dependent upon primary frontal sinus disease are, according to Germann (*Mitt. a. d. St. Petersburger Augenh.*, Ht. 5, 1908):

1. Phlegmon: Benign orbital cellulitis, non-purulent, arising from the lymphatics. Malignant—purulent caries and necrosis.
2. Cysts, consisting principally of orbital mucocele.
3. Optic neuritis leading to optic atrophy; irritation of the 1st and 2nd divisions of the 5th nerve.
4. Panophthalmitis.

The symptoms of orbital complications vary according to the nature and character of the primary affection. In 70 cases of periostitis Germann found changes in the orbit in 27, edema and infiltration of the lids in 38, of the ball in 25, uveitis, keratitis and other affections of the eye, including choked disk in 16, and lacrimal fistule in one. The usual *signs*, those common to most cases of orbital involvement, are edema, infiltration or emphysema of the lids, particularly the upper, the folds of which are smoothed away, mechanical ptosis; inflammation, chemosis and ectropion of the conjunctiva and probably tenonitis; dislocation forward and outward of the ball with partial or complete immobility; uveitis, optic neuritis; panophthalmitis. Corneal affections early in the disease are rare, owing to the protection of this membrane by the overhanging lid. The lacrimal gland and sac may become involved and, indeed, may furnish the principal signs of frontal sinus dis-

ease—leading to error in diagnosis. The signs are modified by the progress of the disease, keeping step with its various phases.

The principal *subjective symptoms* are headache, neuralgia of the 5th, diplopia, vertigo, vomiting, insomnia, mental depression, and sometimes chills and fever, sensitiveness over the frontal sinus or the inner angle of the orbit, deterioration or loss of vision. The headache is frontal, persistent, intense and aggravated by body movements and by percussion of the skull, by light, noise or attempts to use the eyes. The diplopia is present only when the lid is raised, hence it is seldom annoying and cannot be regarded as the cause of the vertigo or disturbance of the stomach. For the same reason loss of vision is not a conspicuous symptom. The defective vision is due to opacities of the media or pressure upon the nerve in the orbit or in the optic canal. Birch-Hirschfeld pointed out that astigmatism of the cornea may be produced by pressure on the ball. Schoen says the headache is characteristic and is accompanied by cramp of the accommodation and of the internal recti. Hajek, however, says the localization of the pain is not typical. Radiography and transillumination are extremely useful in determining the diagnosis and may be employed with advantage during the course of the disease. Naturally their sphere of usefulness is limited to the cavities other than the orbit, excepting in cases of bony or other hard orbital growths. Birch-Hirschfeld calls attention to two forms of sinusitis without external signs of inflammation in the orbit or neighboring tissues, but

(a) With ophthalmoscopic signs of optic neuritis, neuroretinitis, retinal phlebitis or hemorrhages, and

(b) Without ophthalmoscopic signs, but with disturbance of vision, such as central scotoma, limitation of fields, muscular paralysis or trophic disturbance from interference with the function of the 5th pair of nerves. Finally, the history may throw some light on the diagnosis, for example, traumatism, or a record of recurring colds, rhinitis after infectious diseases, as measles, scarlet fever, or influenza, or changes secondary to syphilis or tuberculosis of the bones or brain tumor.

The function if not the integrity of the eye and its appendages are seriously compromised by disease secondary to sinu-

sitis. Early and radical treatment may be effective in checking the disease and saving the ocular structures. Frequently, however, the prognosis is unfavorable, because of optic atrophy, muscular paralysis and permanent dislocation of the ball. Attempts to drain the orbit with free incisions are almost valueless. Opening the frontal sinus by trephining or the operation proposed by Arnold Knapp (*Jour. Amer. Med. Asso.*, July, 1908), is to be recommended. The latter permits of the examination and treatment of the frontal sinus and causes comparatively little disturbance of the eye or its muscles.

XXIV.

SOME OCULAR SYMPTOMS OF DISEASES OF THE  
NASAL SINUSES.\*

BY WM. CAMPBELL POSEY, M. D.,

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During the past four years, under some such title as this, I have contributed a number of papers upon the subject under discussion this afternoon, and while I have nothing new to add to the observations of others or to the various points in the symptomatology to which I have made reference elsewhere, I am glad of this opportunity to speak of several phases of the subject which may perhaps bear further elaboration.

And first as to the symptoms of eye-strain which may be evoked by a sinusitis. In this assemblage, mention need not be made of the orbital and periorbital pain which the various forms of inflammation of the sinuses may evoke, but I would call attention very briefly to the dull ocular pain, to the photophobia and the conjunctival symptoms after any use of the eyes, which glasses fail to relieve and which disappear after rhinologic treatment. In this class of cases the oculist finds difficulty in determining the proper axis of the cylinder, in correcting the astigmatism, and observes various vagaries in the behavior of the ciliary muscle. If referred to a rhinologist, there will be found, as summarized for me by Dr. Packard, following the observation of a large number of cases studied in common with him, a "septal spur or deflection upon which the swollen turbinate impinges, or congestion of the sinuses, with possibly an accumulation of nonpurulent secretion within them, due to the occlusion of their orifices by swelling of the turbinate tissues." I take it that such intranasal conditions are often not striking and may be readily overlooked, but unless they are properly cared for, the ocular symptoms will persist

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despite every local application which can be made to the conjunctiva or any combination of lenses that may be ordered.

It is in this class of cases that the ophthalmologist often masks the real source of the asthenopia by drying up the nasal and sinus mucous membrane by the atropin which he employs to put the ciliary muscle at rest, the disappearance of the symptoms being due quite as much to the subsidence of the nasal as the ocular congestion.

Another conclusion of Dr. Packard's is that "there is a very large class of cases which present not only asthenopia but other ophthalmologic symptoms as well which are undoubtedly attributable to old sinus trouble, but in which at the time they are seen by the rhinologist no pus is to be found in any of the sinuses, although the history points to sinus origin of the patient's catarrhal trouble. These are cases which give a history of grippe with intense head pains, followed by a profuse purulent discharge from the nose, leaving later more or less so-called catarrhal trouble in reality originating from the sinuses."

This seems to be a most important observation, and is in line with a statement of Axenfeld, that in cases of orbital cellulitis, in which the nasal examination is negative, the original sinusitis which occasioned the orbital condition may have healed by evacuation into the nose, while the orbital condition is progressive, on account of the absence of drainage. Indeed, Axenfeld was able to actually demonstrate by exploratory trephining that the original sinusitis may be healed at the time the orbital condition is under treatment.

In this condition of active and passive hyperemia of the orbital tissues, the function of the extraocular muscles, as well as that of the intraocular, may be interfered with and double vision may result, or if diplopia be not complained of it can be obtained by careful search in the extreme periphery of the field of activity of the individual eye muscles. I have already recorded a number of such cases, and a transient imbalance of the ocular muscles is often suggestive to me of some trouble within the sinuses. More constant and serious affections of the muscles of the eye may result from a more active state of inflammation within the sinuses, and actual palsy may occur either as a consequence of the juxtaposition of some of the eye muscles with the walls of the orbit, such as the internal

and superior rectus, or by an involvement of the nerves which supply them as they pass along the wall of the sphenoidal sinus.

A second point of interest is whether inflammations of the uveal tract, such as iritis and kerato-iritis, may be evoked by inflammations within the sinuses. Zeim, Fromaget, Fish and others affirm that they have observed such an association and follow treatment of the sinuses. Fage contends that ozena follow treatment of the sinuses. Fage contends that ozaena bacilli can reach the eye from the nose and there set up an iritis. Such a transference of bacteria or toxines from the nose or nasal cavities has never been proved in a single instance, and as Axenfeld says, "The occurrence of bulbar inflammations in these nasal affections can quite as well be explained by a localizing and predisposing reflex circulatory disturbance, due to the neighboring affection, while the true exciting cause of the iritis, scleritis, etc., is perhaps something quite apart from the nose."

Although Dr. de Schweinitz has referred at length to inflammation of the optic nerve from sinusitis, I should like to again call attention to the retrobulbar edema of the nerve which sometimes occurs in acute involvement of the sphenoidal and ethmoidal cells. I have observed quite a large group of these cases after sea bathing in conjunction with Drs. Packard, Freeman, Stout and others, the patients in nearly all instances first consulting me for their ocular condition, being ignorant of any nasal affection. Examination of the affected eye, for as a rule but one eye was involved, reveals some haze of vision, but a much more marked diminution in the light sense, relative scotoma at or near fixation, pain on pressing the eyeball back into the orbit, and at one or more points in the rotation of the eye through various meridians, choking of the lymph sheaths of the central vessels of the retina, with perhaps some blurring of the edges of the nerve, and not infrequently a partially dilated pupil. The recognition of this set of symptoms and the reference of the patient to a rhinologist, is usually attended by the prompt subsidence of the ocular symptoms, whereas the failure to appreciate the proper source, condemns the patient to a long course of treatment with salicylates and may terminate in more or less serious ocular and nasal sequellae.

As a fourth point, it may not be amiss to refer briefly to the frequency with which orbital inflammation is dependent upon diseases of the sinuses. Birch-Hirschfeld has compiled some interesting figures in this connection and as his paper was published comparatively recently and in an ophthalmological journal, and thus may have escaped the attention of rhinologists, their recital may not prove tedious.

Of 684 cases of orbital inflammation Birch-Hirschfeld found that at least 409 (59.8 per cent) depended upon one of the sinuses, and he believes that the percentage would have been still higher if examination of the sinuses had been made in all cases. Of these 409 cases, 129 (29.8 per cent) showed involvement of the frontal sinus, 89 (21.8 per cent) of the maxillary antrum, 83 (20.5 per cent) of the ethmoid cells, and 25 (6.1 per cent) of the sphenoidal sinus. In 60 cases (14.7 per cent) several cavities were affected, most frequently (25 times) the frontal and ethmoidal, then the ethmoidal and antrum (12 times), and finally the ethmoidal and sphenoidal (10 times). In almost all cases the condition was chronic or acute purulent sinusitis, so-called sinus empyema, which had followed rhinitis, influenza, pneumonia, scarlet fever and diphtheria, or after traumatism.

Birch-Hirschfeld found that blindness, which occurred in 66 out of his 409 cases (16 per cent) may be produced by empyema of the frontal, ethmoidal and antral sinuses. The optic nerve may be involved by the pus burrowing its way to the apex of the orbit, or the blindness may be evoked by thrombophlebitis of the optic veins. This was especially the case in antral empyema. Fifty-two out of the 409 cases (12.7 per cent) were fatal. Of this number 28 per cent presented sphenoidal, 16.3 per cent frontal, 14.6 per cent maxillary and 6 per cent ethmoidal sinusitis. He found that the mean death rate is not so great as in orbital inflammation without sinus affection, which was 17 per cent in 275 cases, since treatment of the disease exerts a beneficial influence upon the orbital inflammation, thrombophlebitis also occurring less often than in so-called true orbital inflammation. The postmortem examination revealed meningitis in 34 instances, frontal abscess in 15, and sinus thrombosis in 6. Four patients died of pneumonia, two of sepsis.

In conclusion, let me once more urge the desirability, nay,

the necessity, of intelligent co-operation between rhinologists and ophthalmologists in the treatment of the class of cases under discussion. He who does not combine both specialties in his practice will in many instances not place at the patient's disposal all that science has achieved in the way of diagnosis and treatment of affections of the accessory sinuses, unless he avails himself of the services of a rhinologist, if he be an ophthalmologist, or of an ophthalmologist, if he be a rhinologist. Both should work hand in hand and the skill of both will often be taxed to bring obscure cases to a successful issue.

XXV.

EXTRALARYNGEAL CAUSES OF LARYNGEAL  
SYMPTOMS.\*

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Modern specialism in medicine tends to segregation. The spirit of the times is an eager one. The search for new facts, the testing of new theories and the acquirement of new methods confines each of us to the particular rut along which some previous training has given impetus. This holds for all branches of the profession, whether one is doing the day's work with tuning-fork and tracheotomy tube or using percussion-hammer and stethoscope. He would, indeed, be an odd and a marvellous man who has not found, occasionally, that the limit of his own skill and wisdom lay beyond the boundaries of his particular clan, be he oto-laryngologist or internist. To many of us this limbus is reached all to soon, and we are continually impressed with the interdependence of the various branches of our art, and the disadvantages of a too rigid or a too premature specialism. The text implied in these observations furnishes the *raison d'être* of this paper. It is not my purpose to wander into new fields, but to tread the much travelled paths of both laryngologist and internist, laying emphasis, so to speak, upon the sign-boards that mark the crossing of our ways. And, if, like Kipling's "Kim", I misconstrue these signs, then the faults of rendition must find excuse in the sincerity of the intention.

I believe that I but express the convictions of the large majority of internists, when I say that cases all too frequently come to our examining rooms which would compel us to submit but hesitating diagnoses and prognoses,

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and certainly to administer inefficient treatment were we not able to secure certain positive facts from the laryngologic expert. And, perhaps, I shall not be considered too bold, when I state that many laryngologists have experienced the satisfaction of having, for example, such anomaly as an obscure paralysis of a vocal cord cleared up by a careful physical examination of the zone below the clavicles. If these premises are warranted, then, perhaps, it would not seem necessary to emphasize an openness of mind and hearty co-operation in both examination and treatment, when the welfare of our patients is uppermost.

The peculiar anatomic situation of the larynx permits of a bewildering multiplicity of disturbances in the functions of the surrounding structures and also gives opportunity for abnormalities in adjacent or related parts to make themselves manifest in the larynx. These manifestations may result in gross anatomic changes in the organ itself or give rise to functional disturbances in the dual work which the larynx has to perform, namely, phonation and respiration. It is to be assumed that when the laryngeal process is a primary one its recognition has been possible. It is to the class of pathologic changes apart from the larynx, but with distinct symptoms pointing to abnormal conditions within the organ that we would invite attention. To confine the subject within the limits of this paper, it will be necessary to take up the consideration of these conditions somewhat systematically. It will be recognized that the field is a broad one, and hence, if the consideration resembles Homer's famous "Catalogue of Ships", I crave your indulgence.

In the main, this class of laryngeal impairments may be due to malfunction or faulty construction of the nervous system—central or peripheral—of the circulatory system and the blood carried, of the respiratory system, apart from the larynx, of the digestive tract—adjacent and remote—of the genito-urinary system, of the supporting and contiguous parts of the larynx, as muscles, glands (thyroid, parathyroids, thymus, lymphatics), vessels, and of congenital imperfections. The evidences of faulty functioning on the part of the larynx are mainly those resulting from actual loss of function on the part of related structures or from pressure upon the larynx itself or adjacent parts.

But little attention need be given here to that class of disturbances occurring in the so-called diatheses, e. g. rheumatism, gout, rachitis, etc.

Fortunately for both patient and medical attendant, improper working of the intricate mechanism of the larynx, in either of its special fields—phonation or respiration—makes itself known very early and leads to examination, generally local. These manifestations are commonly dysphonia—hoarseness, whispered voice, etc.—aphonia, disturbances in respiration, cough, pain, dysphagia, hemorrhage, the presence of sputum, or external evidences of faulty movement or construction of the larynx as a whole. Laryngoscopy, even when the cause is not primary in the larynx, may reveal pallor, hyperemia or abnormal pigmentation with swellings, variations in the position or movements of the integral parts of the organ, with or without the presence of atypical secretion.

Among the most important, and often the most puzzling disturbances in the functioning of the larynx are those resulting from some impairment in the nervous system. This impairment may be central, peripheral or entirely functional. The common central lesions are those associated with the brain and its ganglia. They are responsible for a multitude of laryngeal symptoms. When the brain is directly involved—as in hemorrhage, embolism, thrombosis, abscess, gummi, new growth, encephalomalacia, anemia, tophus or external pressure—there may result paralysis of one or both cords, with or without paralysis of the extrinsic muscles, spasmotic contractures of these muscle groups, local anesthesia or occasionally hyperesthesia. The parts involved are frequently characteristic for the local area of the brain diseased. Clinically, the manifestations may take the form of cough, difficulty in respiration, aphasia, dysphonia, alterations in voice, quality and manner of enunciation, local or general nutritional disturbances, or alterations in the normal secretion of the laryngeal mucosa.

When the spinal cord and its nerves are involved, the results are frequently not dissimilar to those following cerebral impairment. The causative factor may be infection, hemorrhage, tumors, scleroses, atrophy or pressure,—as from vertebrae following injury or disease. The laryngeal symptoms are not so marked as a rule as in those cases

where the brain is involved. There may be cough, frequently paroxysmal, hoarseness, scanning speech, yawning respirations, disturbances in sensation and tickling or burning of the mucous membrane. Interference with the proper function of the sympathetic nerves may bring about variations in the co-ordination of the individual parts of the larynx with dysphonia, cough and sometimes respiratory distress.

When the laryngeal disability results from a so-called pure neurosis, complete loss of voice, whispering, interrupted speech, inability to pronounce certain words and phrases, or to produce high tones may follow. Frequently the condition is entirely negative from the laryngeal standpoint, or the changes in the larynx may be extremely slight, sometimes just enough to focus the attention of the patient upon that organ. Generally, there is a history of mental strain or shock. Often only the most careful neurologic examination and from standpoints other than the throat is required before the true cause of the disturbance can be ascertained. It is needless to emphasize the importance of this with respect to the immediate or future prognosis of the case. During the past five years, three cases of hysterical aphonia have come under my observation. In all the cases, some intrinsic laryngeal condition could have been suspected. It was only after careful examination from every standpoint that the conditions were proven to be pure neuroses, and proper treatment instituted.

Among other neuroses I might mention those alterations in voice, frequently hoarseness and sometimes cough, associated with the normal physiologic sexual cycle of the female. These are most common at menstruation, pregnancy and the menopause. I have at present under my care three females who have annoying cough during one or more days of the menstrual period. Two of these patients were victims of marked phthisophobia, until assured that there was absolutely no condition in either larynx or lungs that could be considered causative. In one, the tuberculin test had to be resorted to before the patient and her family were satisfied. It is certainly within the experience of all of you that pregnant women occasionally complain of laryngeal tenderness and sometimes of actual pain. A few of

them are bothered with troublesome cough. These symptoms are most frequently found in neurotic and anemic primiparae.

Neuroses in the male are not so common as in the female. However, they may be present. So called "habit-coughs" and "throat clearing" may occur. These may be associated with functional neuroses of the abdominal viscera, in either male or female. The most common of these is gastric hyperacidity, with more or less marked spasm of the cardiac or pyloric rings. The cough is frequently associated with gastric distress and burning sensations in the stomach, esophagus or throat. It is most common to have the patient exhibit the cough after indiscretions of diet and at the height of digestion, hence between meals and at night. The character of the cough varies. It is usually high pitched, harsh and not accompanied by sputum. There is frequently a burning sensation in the region of the larynx. The cough is often accompanied by acid eructations, and if paroxysmal, may be followed by acid vomitus. It is generally relieved by washing the stomach or by doses of olive oil or by one of the alkaline preparations. In cases of continuous hypersecretion—Weil's Disease—the cough may be almost constant, having little relation to meals, and may then result in secondary changes in the mucosa of the larynx. It is not impossible for these to be taken as the primary causative disturbance in hasty examination, and this is particularly the case when an anamnesis has been neglected or but poorly made. Other reflex neuroses, as laryngismus stridulus, angioneurotic edema, urticaria and the like, may result from gastro-intestinal irritation, particularly in rachitic and syphilitic children and in neurotic women.

Before passing to a consideration of the effects of pressure of thoracic viscera upon parts related to the larynx, it would perhaps be well to mention the effects of pressure in the neck itself. These may be from retropharyngeal abscess, injuries to the spine, enlarged cervical glands, enlarged thyroid, persistent thymus, abnormally large or cystic parathyroids, aneurysms, esophageal new growths, foreign bodies and branchial cysts. The enlargement of the cervical glands may result from an acute infection, and may, as in certain cases of diphtheria, bring about symptoms

on the part of the larynx from pressure upon related parts, simulating tracheal or intralaryngeal exudation. Other causes of enlargement of the cervical glands may be tuberculosis, syphilis, Hodgkin's Disease, leukemia, sarcoma, carcinoma or cysts. Here again the effects of pressure result from direct involvement of the larynx or related parts. Pain and cough are common clinical manifestations. The cough may be paroxysmal or almost constant, leading the patient to consult the laryngologist very early. Sometimes the effects of intralaryngeal irritation are so marked that the affair may be taken for a primary, local one, and local treatment instituted, often without avail. The cough may be complicated with frothy or bloody sputum, and may be particularly severe at night when the patient is recumbent. This latter occurred in my experience in two cases of Hodgkin's Disease, one spleno-myelogenous leukemia, with terminal glandular enlargement, and one case of sarcoma, with severe anemia.

Severe cough from enlargement of the thyroid or the thymus is common. It is usually associated with external evidences of the gland enlargement in the case of the thyroid. Not infrequently, however, the thyroid may be but slightly enlarged internally and yet the evidences of pressure from internal enlargement of the whole or a part of the gland are not wanting. This is particularly the case in incipient, atypical Graves' Disease. The cough, with slight sputum, the associated weakness, loss of weight, and sometimes fever, may, on superficial study, readily lead to the diagnosis of incipient pulmonary tuberculosis or a similar process in the larynx. Sputum examinations, tuberculin tests and laryngoscopic examination are however negative. The signs of Graves' Disease should be most carefully searched for. The tremor, tachycardia and the eye phenomena may become more manifest and so clear up the picture, after diagnostic administration of thyroid extract. Appropriate treatment with thyroidectomy, serum or by surgical means may result in the disappearance of the laryngeal pain and cough. Simple parenchymatous or cystic enlargement of the thyroid may also produce cough, dyspnea and pain. Thyroid extract, puncture of cysts or surgical intervention may be necessary before the effects of pressure or irritation of nerves disappear. Cysts of the salivary

glands occasionally occur. They may reach great size and early cause pressure symptoms. New growths, foreign body, or diverticulum in the esophagus may be responsible for chronic cough, pain on swallowing or dyspnea. Examination with esophageal bougie or esophagoscope should be performed when slight alterations are found in the larynx. Branchial cysts are rare. I have seen two within the last three years. In both, cough, dyspnea and laryngeal pain were present.

Laryngeal symptoms from alterations in the thoracic viscera are not uncommon. The heart and great vessels, the structures of the mediastinum and the lungs themselves may be involved. The manifestations are generally the effects of pressure. The pressure may be upon the larynx itself, by extension of the aneurysm, upon the related nerves, upon the parts adjacent to the larynx or upon related ganglia.

When the heart and the great vessels are involved, the most frequent cause is aneurysm. The aneurysm may be of the heart itself, the great vascular trunks, particularly the arch, or, secondarily, the great vessels ascending into the neck. Occasionally—as happened in a young man under my care about two years ago—the formation of a heart thrombus may result in such enlargement of the right auricle with coincident embarrassment of the circulation, that the effects of aneurysm are closely simulated. The symptoms on the part of the larynx vary with the location of the aneurysmal sac. Early "brassy" cough with or without sputum leads commonly to laryngoscopic examination. This may reveal nothing beyond slight redness of the mucosa, tumefaction or extremely slight and apparently insignificant alterations in the movements of related parts. Later the cough becomes violent and frequently paroxysmal. It may be associated with bloody sputum. Even then expert laryngeal examination may reveal nothing very positive. It is at this stage that there is danger of ascribing the local hyperemia or swelling to something primary in the larynx. Superficial examination of the neck or thorax may discover nothing apparently causative. The proper diagnosis may not be returned until later when there is either external thoracic tumor, or when a most careful scrutiny of the thorax with the patient stripped, reveals

the presence of such definite physical signs as atypical cardiac dullness, atypical pulsations or the presence of extracardiac bruits. The subsequent examination with fluoroscope, blood pressure machine and sphygmograph confirm the physical findings. From a somewhat varied experience, I may be pardoned if I cite the following cases to show that this thorough examination of the thoracic viscera is not infrequently neglected:

CASE I. Mr. B. entered the University Hospital September, 1906, on account of dyspnea, cough, sharp, lancinating pains in the left back and neck, aggravated by lying down and more troublesome at night; pain in the left arm, anorexia, vague feelings of discomfort in the precordia, dizzy spells when the dyspnea was most marked. The trouble was apparently of a year's standing. The patient denied lues. There was no history of rheumatism or other infectious disease, nor of injury to the thorax. He had been treated for throat trouble and had had gargles and various cough mixtures administered for the greater part of the year previous to entering the hospital. He was finally sent to the hospital by a physician who told him that he had heart trouble. When he was stripped for examination, it could be readily seen that there was a distinctly pulsating, slightly elevated area in the thorax, over the left upper, anterior region, centering in the second intercostal space, parasternal line, extending inwards to the mid-sternal region, outwards to just below the mid-clavicular line, upwards to the clavicle and below into the third intercostal space. The prominence was nearly a centimeter higher than the corresponding region of the thorax of the opposite side. The pulsation was heaving, synchronous with the apex beat. There was no prominence to be seen in the back. There was no tracheal tug. The entire tumor area was tender. Over the tumor was a marked systolic pulsation, on palpation, followed by a diastolic shock of moderate intensity. The pulsations conveyed the impression of being slightly expansile. The radial pulses were unequal, the right being considerably fuller than the left. Percussion revealed a large, atypical area of dullness, corresponding to the position of the left end of the transverse and the upper portion of the descending portion of the aortic arch. This was confirmed by radiogram. Auscultation disclosed the

presence of a systolic bruit at the apex of the heart, and over the arch of the aorta, at the site of the enlargement. The diastolic shock was moderately intense. Auscultation at the back of the thorax revealed similar but less pronounced signs. The lungs and larynx were negative. There was no Drummond's sign. The blood pressure, on the right, at the radial, with the Erlanger apparatus, 12 cm. cuff, was as follows: Systolic 139 mm. Hg., Diastolic, 103 mm. Hg.; of the left radial, Systolic 118, Diastolic 86 mm. Hg. Diagnosis: Aneurysm of the left portion of the arch of the aorta, with probably diffuse dilatation of the entire arch; cardiac hypertrophy.

CASE II. Mr. H. entered the Medical Clinic of the University Hospital, Oct. '07, on account of dry, persistent, hacking cough, dyspnea, especially when lying down, pain in the right neck and in the right side of the thorax at the level of the lower ribs, and radiating to the back, along the ribs, colicky pains after eating, loss of weight—40 lbs. since the preceding February—and weakness. The history was negative, with the exception of moderate use of alcohol and tobacco, and three attacks of gonorrhea. The patient had retired from business three years previous to coming to the hospital, on account of cough and dyspnea. Six months before entering he had had more severe attacks of coughing brought on as he suspected from exertion and getting cold. The pain in the neck and thorax had become more pronounced during the last three months. This patient had also been treated for throat trouble, intercostal neuralgia, and more lately for enlargement of the heart. The examination, with the patient stripped, revealed moderate cyanosis over face, mucous surfaces, neck and upper part of the thorax. The superficial veins over the upper part of the thorax and neck were engorged, the jugulars were prominent; the laryngoscopic examination by Prof. Canfield showed slight infiltration of both cords, especially near the vocal processes, giving the appearance of a moderate degree of internal paresis. There was slight tracheal tug when the patient sat up. Physical examination of the thorax disclosed enlargement of the heart in all directions, with fairly good compensation. At the base of the heart and to the right largely was an extensive area of dullness extending beyond the mid-scapular line, and occupying the upper

sternal region; no expansile pulsation could be made out. There was faint suggestion of diastolic shock. Auscultation was as follows: Sounds muffled throughout; first sound at apex impure with suggestion of soft systolic bruit not transmitted to axilla; second sound faintly heard at apex; heart sounds become more distinct up the left edge of the sternum; they are very weak over the base of the heart, the aortic second being barely audible; the second sound over the upper portion of the sternum and in the second left interspace is accentuated and impure, with a suggestion of roughening; there is no arrhythmia. The blood pressure was, systolic, 150 mm. Hg. (Erlanger.) Fluoroscopic examination revealed the presence of a large pulsating mass in the median line, occupying the upper two-thirds of the sternal space. The radiogram showed that the mass extended farther to the right than to the left. Diagnosis: Aneurysm—diffuse—of the aortic arch; cardiac hypertrophy.

It will be seen from the brief resume of these cases that cough and pain with more or less dyspnea, early directed attention to the larynx. In the first case, there was no laryngeal alteration that could have been called causative; in the second there was distinct alteration in the mucous and the vocal cord movements. Both the patients reviewed died within a year after entering the hospital. Early and careful examination of the thorax would have doubtless led to the discovery of abnormal conditions, and the lives of the patients may have been prolonged. The futile attempts to relieve cough and dyspnea by the laryngeal route are apparent.

Dyspnea, frequently referred to the larynx is not uncommon in aneurysm. It may or may not be associated with cough, cyanosis and alterations in the character of the voice. The dyspnea may be inspiratory or expiratory. The inspirations may be short, high-pitched and sometimes crowing; the expirations may be long drawn-out, wheezy or grunting. Alterations in the quality of the voice and in phonation are common. At times the patient may not be able to speak above a whisper. Hoarseness, inability to pronounce certain letters of the alphabet, disturbances in laughing or singing may be prominent. Disturbances in swallowing are occasionally present. There may be regur-

gitation of food after the swallowing act. Abnormal movements on the part of the larynx are not so common as the literature would lead one to suppose. So-called "tracheal tug" may or may not be present. When it is present, it is certainly significant of alterations in either the heart or the great vessels. In aneurysms as we have seen, direct examination of the larynx may reveal marked hyperemia, edema, swelling and alterations in the mobility of the parts. The symptoms are generally out of proportion to the positive laryngeal findings.

Extension of an aneurysm beyond the boundaries of the thorax should not be forgotten, as for example, the effects of pressure upon the larynx of multiple, aneurysmal dilatations of the carotid artery. In these cases, the effects of direct pressure are generally pronounced, and the conditions readily differentiated. Occasionally, however, one hears of an aneurysmal sac being aspirated for diagnostic purposes, under the impression that the case is one of cyst. Rupture of an aneurysmal sac into the larynx with acute and fatal hemorrhage sometimes occurs.

Diseases of the tissues of the mediastinum may closely simulate affections of the heart and vascular trunks insofar as their effects on the larynx are concerned. These affections may be primary or secondary. The pathologic process may be carcinoma, sarcoma, lymphoma or cysts. When primary the process may have its origin in thymus remnants, lymph glands or connective tissue. When secondary, any or all of these structures may be involved.

The symptomatology, from the laryngeal viewpoint is well illustrated by the following cases:

CASE I. Mr. L. H. entered the University Hospital in January, 1907, on account of difficulty in breathing, palpitation of the heart, chronic cyanosis, frontal and occipital headaches, dropsy and general weakness. The patient said that he was in good health up to ten years ago, when he suffered several attacks of "asthma", at which times his "wind would be suddenly shut off by a pressure just above the top of the breast-bone." Occasionally, he became unconscious. When he recovered consciousness he would have palpitation for some time afterwards; blueness of the face, hands and neck became noticeable. He said that he had improved at times under medication. In 1906, the dyspnea,

cyanosis, feeling of thoracic constriction and sensations of smothering became more marked. Cough developed, with hoarseness, sometimes whispered voice. The dyspnea, cough and change in the voice were paroxysmal and generally worse at night, when the patient lay down. More recently, the cyanosis has become more marked and edema of the ankles had appeared. Examination disclosed displacement of the heart inward towards the sternum. A large area of atypical thoracic dullness in the region of the mediastinum, which radiograms proved to be due to infiltration of the mediastinal tissues and the adjacent lungs, could be made out. The larynx was negative, at several examinations. There was no tracheal tug; the liver was slightly enlarged. The blood revealed marked erythremia, the red cells numbering at times more than 9,000,000 per cubic millimeter: the urine contained varying amounts of albumin and casts. Other features of the case which should be emphasized are the paroxysmal nature of the symptoms; periods of comparative freedom from cough, dyspnea or cyanosis; then again the changes would be particularly marked with whispered voice, sometimes actual aphonia, barking cough, without sputum, extreme grades of inspiratory dyspnea with prolonged, sibilant expiration. And with all these symptoms pointing to laryngeal change, expert laryngoscopic examination revealed no alterations in the larynx.

CASE II. Mr. J. W., boilermaker, entered the Medical Clinic at the University Hospital on account of sense of constriction across the upper thorax; occasional "choking sensations" in the throat; shortness of breath with gasping, crowing inspiration; insomnia; morning nausea without vomiting; weakness and headaches. The history was negative with respect to syphilis, acute infections, foreign body or excessive use of tobacco. About a year previous to entering the hospital, the patient noted gastric distress, insomnia and a sense of pressure beneath the upper sternal region. He began to "get winded" with little exertion and his face became cyanosed. His voice became husky. Dyspnea developed with "whooping" when he drew a breath. There was frequent cough without sputum. Examination revealed a slight cardiac hypertrophy, the presence of an infiltrating mass in the mediastinum, as shown by physical

examination and radiograms; and of mucous gastritis. The larynx was abnormal in so far as both cords abducted to the cadaveric position and were slightly retracted; they were moderately injected; on phonation the right cord was negative; the left showed imperfect approximation to the vocal processes posteriorly. Blood and urine were negative. In this case also, the paroxysmal nature of the cough, the dyspnea, the high-pitched crowing inspirations, the hoarseness and the feeling of upper thoracic constriction should be emphasized.

When the lung is involved, as in tuberculosis, syphilis, tumor, acute infections, bronchiectasis or by foreign bodies in one of the air passages, cough, pressure symptoms, dyspnea and pain may be referred to the larynx. It is certainly not an uncommon experience to have had cases of incipient pulmonary tuberculosis receiving local treatment for the larynx in the belief that this process was primary, long after the physical signs and the clinical symptoms are indicative of considerable involvement of pulmonary tissue. While the early anemia of the laryngeal mucosa gives significant information, with respect to the diagnosis and prognosis of a case, yet one cannot feel justified in relying upon even careful laryngoscopy to segregate our doubtful cases. Frequent thoracic examinations, before and after the use of an approved tuberculin preparation, subcutaneously administered, should be coupled with local examination of the larynx. It is unnecessary to urge that in all cases of pulmonary hemorrhage, the larynx should be carefully examined. In incipient cases of pulmonary tuberculosis, this is especially important.

In syphilis and new growths of the lungs every effort should be made to locate the primary process. This can only be done by careful anamneses, physical examination and the use of such tests as the Wassermann reaction and the hemolysis reaction for cancer. This especially applies to those cases where the laryngeal alterations are slight and where the question of operation or medical treatment is a vital one for both surgeon and patient. Positive findings in the thorax frequently modify the prognosis decidedly.

In tuberculous patients, the development of a spontaneous pneumothorax may bring about dyspnea, cough, cyanosis and alterations in the voice, which in the event of

discovery of a small focus of infiltration in the larynx may result in local measures entirely to the exclusion of general treatment, indicated by the results of thoracic examination.

Foreign bodies present in the trachea or the bronchi may readily give rise to laryngeal symptoms—as cough, dyspnea, pain, cyanosis and alterations in the voice—which may lead to prolonged search in the larynx for the offending agent, to the exclusion of examination with tracheoscope or bronchoscope. Radiograms furnish invaluable aids to the search for foreign bodies in the air passages, and particularly when laryngeal examination directly has proven negative.

Alterations in the composition of the blood itself may be responsible for serious and frequently puzzling laryngeal symptoms. They are frequently acute and death supervenes before diagnosis has been made or treatment has been instituted. The laryngoscopic examination usually reveals general or local edema, pallor, with swelling of the cords or narrowing of the rima. The common causes of these conditions are those associated with faulty circulation, as in uncompensated heart disease or uremia—those associated with changes in the cellular elements and plasma of the blood, e. g., severe secondary anemia, pernicious anemia, lymphatism, hemophilia and myxedema; and lastly, the changes following the use of such medicinal agents as nitro-glycerin, pilocarpin, adrenalin, orthoform and the like.

Changes in uncompensated hearts are not frequently missed; if the onset of the edema is acute, in either heart or kidney disease. Unless the thorax is gone over or the urine examined, one may readily miss the full significance of the extralaryngeal state.

Laryngeal distress may be pronounced and acute in the various forms of anemia. This is particularly the case in pernicious anemia, leucemia and lymphatism. Cough with dyspnea, especially on exertion, is sometimes pronounced. Frothy or bloody sputum may be present. Negligence in general examination or in examination of the blood, the making of both counts of fresh blood and the differential estimation of the leucocytes from stained smears, may lead to errors in treatment and to disappointments in prognosis.

The following cases of pernicious anemia were associated with marked laryngeal manifestations:

CASE I. Mrs. L. H., aged 30, entered the University Hospital January 1, 1907, on account of anemia, cough, dyspnea, dull pain in upper thorax, and swelling of ankles and eye-lids. The patient had had a cough for eight years and had taken "all sorts" of treatment for it, but to no purpose. At the time of entry, the blood examination was as follows: Reds, 2,227,000; whites, 4,550, and Hg. 37% with the Miescher apparatus. The differential count showed a slight increase in the relative number of lymphocytes. Macrocytes and microcytes were numerous. Poikilocytosis was marked. Normoblasts and megaloblasts were present. The patient remained in the hospital for about a month, showing some improvement at times. At the end of that period, there was sudden decrease in the red cell count, increase in the cough with abundant blood-stained sputum, acute dyspnea and death from glottidian edema.

CASE II. Mrs. McK., aged 21, entered the University Hospital on January 16, 1907, on account of constant cough with blood-stained sputum, nausea, vomiting and numbness of the extremities. She was evidently well so far as she can tell, until three months before coming to the hospital. Then she began to feel weak, to vomit and to cough. Her voice became weak and hoarse; sometimes she could scarcely speak; the glands in her neck began to swell and a physician diagnosed tuberculosis. When she entered the Medical Clinic she was very weak. The larynx showed moderate edema; the blood examination was as follows: Reds, 600,000; whites, 5,600; Hg. 18% (Miescher). There were many poikilocytes and megaloblasts present. The patient lived about two months and died from terminal laryngeal edema, which came on within six hours. The day of her death the blood examination was, reds, 410,000; whites, 12,000; Hg. 12% (Miescher).

CASE III. Mr. W. D., aged 46, entered the University Hospital October 13, 1903, on account of cough, dyspnea and weakness. The symptoms had been present for about nine months and were becoming worse. He had taken several varieties of cough mixture and more recently had been compelled to resort to morphine. The blood examination at the time of entry was: Reds 1,200,000, whites 2,312, Hg. 30% (Tallquist scale.) The differential count showed a great excess of lymphocytes. The reds showed moderate

poikilocytosis, a large number of oval forms and there was considerable difference in the size of the individual reds. The laryngeal examination, with the exception of anemia of the mucosa was negative. The patient remained a few days for treatment. His cough became somewhat better and he left suddenly. He returned, however, the following month, with more marked cough, shortness of breath and weakness. His laryngeal examination revealed considerable edema of the cords and glottis. The blood examination at this time was: Reds, 720,000; whites, 1,900, and Hg. 15% (Miescher). Poikilocytosis was marked; there were many microcytes and macrocytes, and an enormous number of normablasts and megaloblasts. The patient improved for a few days after entering the hospital, but then gradually grew weaker. Cough, dyspnea and laryngeal edema became more pronounced and the patient barely reached home before his death.

Finally, the effects of medicinal remedies with respect to the larynx should not be forgotten. In instances where pilocarpin is being administered for middle ear scleroses, sharp watch must be kept of the patient lest suddenly developing laryngeal and glottidian edema follow with fatal termination of the case. The excessive use of nitroglycerin may be accompanied by similar effects. Locally, the use of cocaine or adrenalin, either frequently in small amounts, or in large amount at one sitting, may be followed by marked and obstinate edema. The same might be said of such a remedy as orthoform, used in painful local conditions of the larynx or where used upon related parts, as in the esophagus, pharynx or nose. Very marked, annoying and painful edema may follow which may even be fatal.

XXVI.

THE CLINICAL DIAGNOSIS OF TUBERCULOSIS  
OF THE TONSILS.

BY LEE M. HURD, M. D.,

NEW YORK.

WITH SOME REMARKS UPON THE MICROSCOPIC  
DIAGNOSIS.

BY JONATHAN WRIGHT, M. D.,

NEW YORK.

The physiologic relation existing between the faucial tonsil and the lymphatic gland situated at the angle of the jaw, anterior to the sternocleidomastoid muscle, has been established.<sup>1 2 3</sup> When these cervical glands are enlarged there is always evidence of disease in the corresponding tonsil. This glandular enlargement is due to septic absorption or to the absorption of the tubercle bacillus. Personally, I believe that all these cases of glandular enlargement start from septic absorption, after the tonsillar resistance has become weakened by disease, so that it may easily allow the tubercle bacillus to gain a foothold and soon invade the cervical lymphatics. I also believe that at times this takes place without leaving much evidence of their passage through the diseased tonsil. This has not yet been established as a fact, but the following analogous facts tend to lead me to believe it may be true.

Wood's experiment of once rubbing tubercle bacilli upon a pig's tonsil, later finding tubercular lesions in its lymph gland, but none in the tonsil.<sup>4</sup> The experiments of Calmette and Guerin on goats<sup>5</sup>—that tubercle bacilli can pass through the intestinal walls without leaving lesions, and even through the mesenteric lymph glands, making themselves first known in the pulmonary apex.

The clinical diagnosis of primary tuberculosis of the tonsil was made in these selected cases on the condition of

the lymph gland that drains the tonsil, as well as the condition of the tonsil itself.

The faucial tonsils may be divided into two classes clinically. First, those that are enlarged, somewhat pedunculated, with most of the tonsil hanging free into the fauces. Such large tonsils are the ones that are usually removed. They are also the tonsils that cause the least systemic harm. True, they interfere with free breathing to a certain extent, but the children that have this class of tonsils are more inclined to be healthy and robust. It seems that the freer the tonsil, the more it resists the invasion of harmful micro-organisms; also it is exceptional to find associated with them much enlargement of the lymphatic glands.

The second class consists of those tonsils which are more or less buried beneath the tonsillar pillars, and which are prone to chronic inflammation rather than to acute inflammation, although they may have acute exacerbations of the chronic condition. This class causes more systemic effect. These tonsils, when diseased, will regularly give enlargement of the glands in the deep cervical chain. The children are not robust, but are more inclined to be anemic and languid, and it is in these patients that we find the proper soil for the invasion of the tonsil, primarily, then the cervical gland, with tuberculosis.

On casual examination, these submerged tonsils appear small and insignificant, because the greater portion is in the space between the pillars and crowds upward, sometimes half an inch, above the highest visible portion of the tonsil. It is in this buried portion that the tubercular evidences are usually found, closely bordering upon the tonsillar capsule. Dr. Wright examined sixty tonsils for tuberculosis, in the days when it was considered necessary to remove only the protruding portion. He did not find it in a single case.<sup>56</sup> This seems to prove two things: first, that the protruding tonsil is rarely attacked by tuberculosis; second, that if attacked the lesion is nearly always found just beneath the capsule, at the bottom of the tonsillar crypts.

The tonsil in which we find evidences of tuberculosis is usually pale, the crypts contain cheesy detritus, the edge of the anterior pillar may have a passive hyperemia, and the associated lymphatic gland is usually much enlarged and

hard. From this early stage it may progress until any number of glands are involved. The question has been put to me—If the tuberculosis has reached the cervical lymphatics,\* why remove the tonsil? There are two very good reasons. First, such a tonsil is allowing microorganisms to take the same route as the tubercle bacillus did, and I believe that this makes it still harder for the lymphatics to overcome the tuberculosis, which it has a fair chance of doing with the tonsil out. This is easily shown by the fact that after removal of the tonsil the lymph glands begin to subside, and if only enlarged from septic absorption will entirely disappear; and in tubercular adenitis there will be a rapid diminution in the size of the glands to a certain point, which I believe was the increased load placed upon the glands from draining a generally diseased tonsil. Also, when the tubercular cervical glands are removed, the tonsil remaining is liable to reinfect the remaining glands, as in case No. 2. The most frequent site for enlargement of the cervical glands is at the angle of the jaw, and in recognizing the tonsil as the portal of infection, its prompt removal will abort many cases and perhaps other more remote tubercular lesions.

I would here like to digress long enough to state that the tonsil must be removed in toto in order to get out the tuberculous portion, and also that the stump of a partially removed tonsil is quite as liable to tubercular infection as if originally submerged. This is probably due to the fibrous cicatrix closing up most of the crypts.

All the tonsils reported in this article were of the submerged variety. From my observations, I would say that the inflammatory enlargement—both septic and tubercular—of the lymph glands that drain the tonsil, are nearly always associated with the submerged tonsil. The tonsil removed from cases of slight glandular enlargement usually showed microscopic evidences of chronic inflammation, but in one of this class the tonsil was typically tubercular. The tonsils from cases in which clinically the glands were considered tubercular or bordering on that condition, had the diagnosis of tubercular tonsil confirmed by the microscope in nine (9) out of the twelve (12) cases.

\*An enlarged lymphatic gland is not necessarily tuberculous.

CASES IN WHICH THE TONSILS WERE CLINICALLY CONSIDERED TUBERCULAR.

No.	Age.	Sex.	Class of Tonsil.	Condition of Cervical Glands.	Microscopic Findings.	75 per cent Tubercular
1	25	M	Submerged, large.	About 3 large glands, hard, of several months duration.	Tuberculous.	+
2	19	F	Submerged, large stumps.	Has had 11 operations for tubercular glands.	Tuberculous.	+
3	22	F	Submerged.	Tubercular abscess at angle of jaw. Opened when tonsil was removed.	Tuberculous.	+
4	27	F	Submerged, fibrous, small.	Enlarged glands angle of jaw 2 1/2 years. Acute peritonitis.	Tuberculosis not confirmed though suspicious.	-
5	12	F	Submerged.	Enlarged glands angle of jaw.	Tuberculosis not confirmed though suspicious.	-
6	4	F	Submerged.	Enlarged glands angle of jaw. 1 enlarged hard gland.	Tuberculous.	+
7	8	F	Submerged, small much cheesy matter	Broken down gland, incised 3 months ago. Now several glands matted together.	Tuberculous.	++
8	8	F	Submerged, small.	Slightly enlarged glands.	Tuberculous.	+
9	3	F	Submerged, medium size.	Small chain of glands.	Not tuberculous.	-
10	8	M	Submerged stumps.	Large gland, two operations.	Tuberculous.	+
11	7	M	Submerged.		Not tuberculous.	-
12	25	F	Submerged, small.		Tuberculous.	+

Note large proportion of females, 75 per cent.

CASES WHERE THE TONSILS WERE CLINICALLY CONSIDERED CHRONICALLY INFLAMED BUT NOT TUBERCULOUS

No.	Age.	Sex.	Condition of Tonsil.	Condition of Neck.	Microscopical Findings.
1	23	F	Submerged.	Slightly enlarged and soft.	Nothing noteworthy.
2	12	M	Submerged.	Slightly enlarged and soft.	Nothing noteworthy.
3	8	M	Submerged.	Slightly enlarged and soft.	Chronic inflammation.
4	6	M	Submerged.	Slightly enlarged and soft.	Chronic inflammation.
5	6	M	Submerged.	Slightly enlarged and soft.	Chronic inflammation.
6	7	M	Submerged.	Slightly enlarged and soft.	Some areas of necrosis.
7	14	F	Submerged.	Slightly enlarged and soft.	Actinomycotic-looking bodies in crypts.
8	6	M	Submerged.	Slightly enlarged and soft.	Chronic inflammation.
9	6	M	Submerged.	Slightly enlarged and soft.	Retrograde metamorphosis.
10	13	M	Submerged, large.	Slightly enlarged and soft.	Typical tubercle.
11	5	F	Submerged.	Slightly enlarged and soft.	Chronic inflammation.
12	8	F	Submerged stumps.	Slightly enlarged and soft.	Chronic inflammation.
13	6	M	Submerged.	Slightly enlarged and soft.	Simple hypertrophy.

I am unable to state the percentage of tubercular tonsils to the total number removed during the same period. All the cases have been selected with the tubercular and chronic inflammatory changes of the tonsil in view, and outside of the throat and neck showed no other signs of tuberculosis.

No. 1. J. H. Male, aet. 25. June 29, 1908. Many carious teeth. Large submerged tonsils, with hard enlarged glands at angle of jaw. Clinically considered tubercular. No other evidences of tuberculosis.

*Microscopic examination, by Dr. Jonathan Wright.*—This tonsil is a good illustration of the grounds I have for calling areas in tonsillar sections "suspicious" of tubercle. In one of the three sections there are granular areas where the proliferation of the round cells are becoming granular and taking the stain badly; nearby are some old fibrous areas. Another section shows this more marked, with the addition of epitheloid cells and the contiguity of the fibrous areas. Still a third section shows all this plus two imperfect giant cells in these areas. I should, therefore, say that this appearance is strongly indicative but not yet, to me, entirely conclusive of the existence of typical tubercle. In this case, from the clinical history and the objective examination, there is little doubt that the glands in the neck are tuberculous. Later, 10 more slides were examined. In many of them there was the well-marked identical area of tubercle-granulum, of epitheloid cells, and in one of these supplemental 10 slides there was in this area a fairly well marked giant cell. Diagnosis: Tubercle of the tonsil.

I avail myself of the report of this case to furnish me with an opportunity of making the remarks upon the microscopic diagnosis of tubercle which have so often formed the substance of our informal conversations in the course of the work with which you have been engaged. As you know, some criticism has been expressed at my unwillingness in many cases definitely to declare there were no evidences of tuberculous processes in a given tonsil submitted to me for examination. It is, of course, a familiar rule in making a negative report on a specimen of sputum to remain on the conservative side by saying that no tubercle bacilli are found. The limitations of this negative opinion are well understood, but when I have reported that no conclusive evidences of tubercle have been found by me in tonsillar

structure, the position assumed has not been understood. It is the purpose of these remarks to explain the grounds of this undesirable but, to me, unavoidable uncertainty expressed in the form of speech I have sometimes adopted and which it is often so awkward to use in communication to friends of the patient the result of the microscopic examination. This, by the way, to uninformed minds seems to be a sort of mystic shrine from which to expect the oracular infallibility not inherent in scientific terms.

Now, in my mind there is often a very large addition of doubt in the negative expression of opinion as to the existence of tubercle in the tonsil, which is not attached to the diagnosis of bacilli in the sputum. With me, this arises from the conviction that the cytolytic emanation of the tubercle bacillus which causes the crumbling of protoplasm may not in lymphoid structure give rise to any of the other structural changes thought to be necessary to the satisfactory identification of tubercle by the microscope. These necrotic areas are not infrequently present in the tonsil, and the most diligent search fails to reveal that they are accompanied by other areas in which are present giant and epitheloid cells. Now, in well recognized tubercle, as in this case, the majority of the necrotic areas do not contain these added characteristics. When areas exist side by side, one containing giant cells and epitheloid cells and connective tissue indications, and the others without them, we do not hesitate to ascribe all to the cytolytic activities of the bacillus. I do not hesitate to believe that such areas of simple protoplasm necrosis may be the sole evidence of the tuberculous nature of the lesion, but I hasten to add that they cannot be considered as processes exclusive of other origins. This, I believe is the kernel of doubt that lies at the bottom of the differences of opinion as to the frequency of the occurrence of latent tuberculosis of the tonsil.

I am convinced that if every tonsil removed in our hospital were examined microscopically (I suppose the number would mount into the thousands every year), and if the accepted evidence of the existence of tuberculosis rested only on the presence of the typical tubercle described by the text-books, the proportion of 5 per cent or 10 per cent would be found to be a gross exaggeration. On the other hand, were we to accept every area of circumscribed granular

necrosis as tubercle caused by the action of the bacillus, without a doubt the proportion would be placed at a higher figure.

While we are upon this aspect of the subject, I might also remark that the word "latent" tuberculosis of the tonsil is misleading, as it is most frequently used. I suppose the term "latent tuberculosis of the tonsils", when originally used, meant a local tuberculosis without systemic clinical manifestation of tuberculosis there or elsewhere. This strict interpretation of the word "latent" involves the shrinkage in the number of cases observed under the microscope as the index of the acuteness of diagnostic acumen on the part of the clinical observer rises. These cases which we have been observing, many of them, now present to your trained eyes clinical evidences of tuberculosis which a few years ago the microscope would only have revealed as "latent." What becomes of our definition, therefore? We expect tuberculous people to have tubercle of the tonsils, but you suspect or tentatively diagnosticate a case as probably having tuberculous foci in the tonsils because you have followed the reports we have sent you and are able to appreciate shades of clinical phenomena which a few years ago you could not do. This is a fundamental weakness of all statistics, but nowhere so glaringly evident as in discussions on tuberculosis. The importance of the statistical argument pales before the mature entertainment of such considerations.

Here, confusion in figures as to the frequency of "latent" tuberculosis depends upon the definition to be applied to a number of ill-defined terms by observers of different degrees of diagnostic acumen. What is patent to you is latent to some one else. What is "tubercle" to me is not the only thing that is "tubercle" to some one else. All these fundamental differences of opinion and capacity are unexpressed in the discussion of the statistics. I think it would be well to give them what prominence we can.

To return from this quite excusable digression to the subject of the "tubercle granulum". As I have said, I know that not all the crumbling areas I see in the tonsil are tuberculous. Some I believe to be due to autolysis, with the transformation of protoplasm into fat or the substitution of fat for the destroyed protoplasm, a process tak-

ing place in the retrograde metamorphosis of the tonsil, and an entirely physiological adjustment of the organism.\* Some possibly may be due to syphilis, though I am inclined to think this very rare. When occurring, the lesion is usually superficial.

The difference between these effects of cytolytic ferments,—that of the bacteriolysin of tubercle and the autolysin,—is commonly ascribed to the efforts the organism makes in the former case to remedy the damage, i. e., the production of epitheloid and connective tissue cells in and around the necrotic areas, but I know no reason why the organism should always thus respond. It may be that the tubercle bacillus in passing through from the surface to the deeper lymphatics of the neck has left this imperfect trace behind it, because of its temporary lodgment. The tonsil, no doubt, is the entry port of a great deal of infection, and if all the virulence of the germs were expended there we should have tonsillar lesions far in excess in frequency to all other lesions of the organs of the body.

Near these spots of granular protoplasm, representing the regression of the tonsil, we have always more or less low grade fibrous tissue, such again as we have around old healed tubercle at the apex of the lungs. Thus you see why it is that I am undoubtedly often in a state of doubt as to how I am to interpret these spots of granular necrosis.

I am reminded by some recent literature upon the formation of the tubercle that in view of your intention to publish the communication I made you in regard to the problem of the microscopic diagnosis of tonsillar tubercle I should briefly refer to the conception at which I have arrived of the usual sequence of events. Virchow and Arnold, and many of the earlier writers, looked upon the formation of the giant cell and the appearance of the epithelial cells as the initial tissue-change in answer to the insult of the tubercle bacillus.

\*In order to avoid repetition of what you may elsewhere find in print, I refer you to the details of the facts upon which this belief was founded originally, remarking that subsequent observation has only confirmed them.

The Fat Contents of the Tonsils. N. Y. Med. Jour., Dec. 15, 1906.

Cysts in Lymphoid Tissue: an Exceptional Manifestation of Tonsillar Regression. The Laryngoscope, Sept., 1905.

This they supposed to be due to the confluence of the fixed tissue-cell into a giant cell and the alteration of others into the epitheloid cells. This is subsequently followed by the accretion of leucocytes from the blood vessels with resulting coagulation necrosis. Many others,—Koch, Cohnheim, Metchnikoff, Yersen, among them,—believe that the nucleated blood cells are the mother cells of tubercle, and from them are formed the giant cells and the epitheloid cells.

So far as the tonsil is concerned, I am inclined to think the leucocytes from the neighboring lymph spaces and capillaries first form a cluster around the point of irritation,—be it bacillus or foreign body, or tissue altered by the influence of either. Epitheloid cells are soon formed, whether from the leucocytes or the fixed tissue-cells I am unable to say, but I am inclined to think they arise from the large and small lymphocytes. By this time, and often before the appearance of giant cells, a certain amount of coagulation necrosis has taken place. The giant cells, when I have been able to detect their genesis, have been arising from the endothelial cells of the capillaries, in accord with the observations of many histologists. By the confluence of these we have a multinuclear cell with feeble cytoplasmic contents. It seems very probable to me that the sequence of events in the formation of tubercle in general is not always the same. The morphological appearances of tubercle differ considerably, and it is quite probable that the giant cells of tubercle differ considerably, and it is quite probable that the giant cell of tubercle is due, like the giant cell of bone, to the confluence of other cells than those of the capillaries, and this may even be the case in the tonsil; but, for certain reasons I do not believe that the giant cell is usually the first step in the process in the tonsil,—rather the last, or next to the last,—fibrosis being more properly a process of repair. It is not necessary to say anything of the fission of nuclei in giant cells as the sole cause of their existence. While nuclei may divide in them, I suppose, I have never detected it, and I am not disposed to think of them as arising in this way.

No. 2. G. McM. Single; age 19. For the past three and a half years has had enlarged cervical glands. Two and a half years ago had first operation on glands. Subsequently

has had ten more operations, making eleven in all. Three years ago had first operation on adenoids, again in four months. Two years ago had still another tonsil and adenoid operation. I found this girl on the side-walk talking to patient No. 3, and on observing large numbers of scars on her neck, induced her to come into hospital and have her throat examined. I found large submerged tonsillar stumps, flush with the pillars; no adenoids; two distant cervical glands enlarging since last operation, some two months previously. I induced her to have her tonsils out. She rather thought it was hopeless, as this made the fourth attempt, but on being informed of their relation to the neck condition she consented, and I enucleated them last April. Dr. Wright found typical tubercle in the tonsillar tissue. Her health has improved so that she has gone back to work, which she has not done in two years. The two glands that were showing a tendency to grow,—one in parotid, other above clavicle,—have receded somewhat. These two glands cannot be directly connected with the tonsillar drainage, but the removal of the primary tonsillar foci seems to have been very beneficial to the girl's general condition.

No. 3. E. McM. Female, age 22; servant. Perfectly healthy except for broken down gland at angle of jaw. Submerged tonsil that looks suspicious of tubercular involvement. Admitted to hospital; neck abscess opened; also tonsil enucleated. Neck promptly healed, and tonsil showed following condition:

Lymphoid material with much subjacent fibrous connective tissue. There are typical Langerhans' giant cells and tubercle granulum deep down in the lymphoid tissue.

No. 4. M. N., Irish, aet. 27. June 3, 1908. For past two years has had glands at angle of jaw much enlarged and gradually increasing in size. In last two months mass acutely enlarged to double former size. Tonsils very small (no history of tonsillitis), entirely submerged. The corresponding tonsil enucleated, and submitted to Dr. Wright, who reported "chronic inflammation," but he remarked that if he saw the same masses of fibrous tissue in a section of the lung he would call it healed tubercle, but was not prepared to so state regarding the tonsil. Seven days after the removal of the tonsil the acute swelling subsided, leav-

ing the old tubercular glands their former size. These tubercular glands did not diminish in size, and about four months after removal of tonsil they showed evidence of breaking down, and a month later were a fluctuating mass. They were now entirely removed. One had become fluid, and the rest,—about six in all,—had cheesy centres. Dr. Wright said: "I presume this is a tuberculous gland, but we have been unable to find typical tubercle in the sections examined." I feel tolerably certain that the tonsil was the port of entry, for the glands first affected drain the tonsil and there is no evidence of secondary drainage into these glands.

Considering the length of time,—over two years,—between development of the adenitis and examination of the tonsil, it seems to me logical to believe that the tonsillar lesion had healed. The patient had the most pronounced enlargement of the glands, with the longest duration, of any of the cases reported, considerably over two years, she says it might be three, since she first noticed their size, and they had probably then been enlarging for some time.

No. 7. L. O'R., aet. 8. Aug. 15, 1908. Very small submerged tonsils. Glands moderately enlarged, with tonsillar gland about size of hickory nut. Microscopic report: "Typical tubercle, giant cells, etc." In the six months since operation all the glands have subsided, except the tonsillar, which is hard and about half former size.

February 18, 1909, the tonsillar lymphatic gland removed; about  $1\frac{1}{2}$  inches in diameter. Its tuberculous condition confirmed by Dr. Wright.

No. 8. M. V., aet. 8. June, 1908. Three months before operation, tonsillar gland and others in relation broke down and drained. Small submerged tonsils. Dr. Wright found typical tubercle in corresponding tonsil; now, after period of seven months, glands have entirely subsided.

No. 9. M. D., aet. 3. May 12, 1905. Submerged tonsils, enlarged glands. Tonsils enucleated. Report: "Sections through tonsils show undoubted evidences of tubercular process. While there are no typical anatomic tubercles, still the presence of masses of epitheloid cells arranged in groups with central coagulation necrosis and proliferating coagulation tissue fibres, the patchy appearance, nuclear fragmentation, makes the diagnosis fairly positive. In addi-

tion to this, the presence of tubercle bacilli can be demonstrated, arranged in clumps."

This child's health has greatly improved; the glands have receded, until now, after a period of over three years, they are hardly palpable.

No. 10. L. K., aet. 8. January 4, 1908. Had tonsils removed,—that is, down to the pillars,—two years ago. This boy has recurrent O. M. S. A., some adenoid; large tonsillar stumps remain that are submerged and partially covered with cicatricial tissue. The tonsillar neck glands are enlarged from size of hazel nut down. Tonsils enucleated. Dr. Wright reports as follows: "These tonsils have many fibrous bands of large diameter traversing the lymphoid tissue; near them the lymphoid tissue is undergoing coagulation necrosis with much hyperplasia of the epithelial or large plasma (epithelioid) cells. There are no giant cells, and the degenerated areas are so scattered that I am inclined to regard this rather as evidence of a retrograde metamorphosis than of old tubercular lesions. Supplementary report: "Sections stained for tubercle bacilli show them apparently in the areas of degeneration. I cannot avoid therefore regarding this as a tuberculous lesion." In the year since tonsillar removal the boy's health has greatly improved, and the glands have subsided.

No. 12. Mrs. L., aet. 30, American. Has had tuberculous cervical glands for two and a half years. Has had two operations with recurrence. Now there is a large mass beneath the sternocleidomastoid muscle. The tonsils are very small and submerged; the crypts filled with detritus.

While this tonsil does not present the crumbling connective tissue areas which I have been accustomed to look upon as suspicious, it shows a number of places where the endothelium of the small capillaries have swollen, obliterating their lumina, and with the bodies of the cells for the most part obliterated, a number of giant cells thus formed is apparent; they do not, however, show the crumbling protoplasm and the nuclei at one pole of the giant cell body with an obliteration of the limiting cell membrane of the other pole, characteristic of the giant cell of tuberculosis.

Another feature of the tonsil is the metamorphosis of the lower line of the surface epithelium. This is being encroached upon by the connective tissue and the round cells

from below, and in many cases it is difficult to reconcile the appearances with any other view than that along this line some of the epithelium is taking on the form and function of connective tissue. I have never been sure that I can detect the microphages (large mononuclear lymphocytes) destroying the epithelium at this line, though it is possible that this process may occur in the way some writers have described. There are many places,—indeed most of the places,—where this view is entirely inadequate to account for appearances.

In this chronic process of inflammation and mutation, the mononuclear lymphocytes are plainly to be seen forming the thick fibrous connective tissue bands of the fibrous tonsil. The swollen endothelium spoken of above as forming a common cell body,—or at least the appearance of it in transverse section (an atypical giant cell as noted) may be seen in many places not to have thus fused its cell bodies; but a bunch of separate cells entirely indistinguishable, at least as to shape (and, with this eosin-hematoxylin stain, as to tinctorial reaction also) from the mononuclear lymphocytes, has formed. We thus have this later connective tissue form of cell, as commonly described, acting as an apparent transition form between not only connective tissue cells subserving different functions, but between surface epithelium and connective tissue. Further, if we imagine a mononuclear leucocyte stripped of its cell body we can at once note the transitional forms between its nucleus and the naked nuclei of the small round lymphoid cells. This has its significance coupled with the fact, now commonly admitted, that the lymph nodes in the tonsil and lymph glands are so-called germ centres arising from a mononuclear lymphocyte as a parent cell, as more fully described for the bone marrow. These lymph nodes we know as physiologic structures; but occurring in hypertrophied tonsils, we recognize a normal process of proliferation in embryonic life carried over into adult life in a pathologic process under the stimulation of inflammation, as I have instanced,—again in a pathological process,—as occurring in the genesis of the bony cysts of the middle turbinate. Now, all this prolongation or reassumption of the mutability of embryonic life in adolescence under the stimulus of irritation (itself the answer to some irritation

of environment) has a bearing upon the heretical opinion I hold of the transformation of epithelium into connective tissue,—a refusal longer to accept in pathological processes the inviolability of the blastoderm layers.

I am very much indebted to the laboratory for the work it has done in these cases. It is out of the question to ask them to convert a suspicious tonsil into sections and examine every section. What has been done, however, is to take the most likely portion of the tonsil and make three or four sections. If these look suspicious, but are not positively tubercular, a few more sections are made; but in this series it has not been difficult to find tubercular evidences in most of the tonsils in the first few sections.

I wish to express my gratitude to Dr. Wright for the interest and work he has given the subject. Without his help, this article would have been impossible. Not my theories, but his facts make it worthy of your consideration.

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XXVII.

THE DIAGNOSIS OF TEMPORO-SPHENOIDAL LOBE  
ABSCESS WITH SPECIAL REFERENCE TO  
ITS SURGICAL TREATMENT.\*

BY W. SOHIER BRYANT, A. M., M. D.,

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The complications of otitic infection have of late years attracted particular attention in the field of surgery. While rapid advances have been made in the management and operative treatment of temporo-sphenoidal lobe abscess, this most serious complication of middle ear infection still remains almost a terra incognita—a disease with most obscure symptoms and often fatal results.

**ETIOLOGY.**—Temporo-sphenoidal lobe abscess is now recognized to be due to some infective process which has invaded the cerebral tissue either by metastasis or by direct extension. Our experience leads us to the conclusion that metastatic conditions are extremely rare. A connection with the primary source of infection can be demonstrated in all recent cases. It is only in the abscesses of long duration which have become enclosed in a heavy capsule that all trace of connection with some more external preexisting infection has entirely disappeared. The cause of temporo-sphenoidal abscess may, therefore, generally be considered to be a middle ear infection which has penetrated into the cerebral cavity.

**PATHOLOGY.**—As we have seen from the etiology, sphenoidal lobe abscess is an infection which has extended into the brain. Its entrance into the brain from its original focus may be by direct extension through the tissues, or by the extension of phlebitis. The first stage is infiltration; the second stage is necrosis; the third is the stage of softening and suppuration; and the fourth stage is encapsulation and resolution. There is

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a final stage which may appear at any time after the first stage—this fifth stage is rupture, either outwardly or, more commonly, into the ventricle, a complication which is soon followed by death.

The bacteriology of sphenoidal-lobe abscess is the same as that of the parent ear infection. In the order of frequency, streptococci, pneumococci, diplococci, staphylococci are found in the abscess. Abscesses of long duration may be sterile.

**SYMPTOMS AND COURSE.**—The initial event in the course of temporo-sphenoidal abscess is infection of the middle ear. For the formation of a temporo-sphenoidal abscess it is not necessary that the infection of the middle ear should cause perforation of the drum membrane, or even cause mastoiditis, but it is necessary that the infection should extend through the upper walls of the drum cavity and infect the cerebrum.

This infection from the middle ear may spread to the brain tissue in four different ways. In the order of frequency, these are: (1) by extension of phlebitis, (2) by ulceration, (3) by coagulation necrosis, (4) by the spread of infection through the tissues.

When silent areas of the brain are involved in a case of sphenoidal lobe abscess, the symptoms may be reduced to a slight earache and somewhat more marked headache, complicating otitis. But when the abscess is located in the active areas and occupies the anterior part of the auditory center it is accompanied by sensory aphasia; if the infection extends to the more posterior part of this region, there will be some evidence of motor aphasia and disturbance of ocular movements. If the abscess has extended to the motor area along the fissure of Rolando, symptoms of motor impairment will follow. The febrile reaction of uncomplicated sphenoidal abscess is always mild.

Brain abscess may not be suspected until rupture, with resultant meningitis, if the abscess ruptures outwardly; or by pyocephalus or cerebrospinal meningitis if the abscess ruptures into the ventricle.

The symptoms of brain abscess are often obscured by the concomitant fulminating symptoms of meningitis and sinus thrombosis; or they may be so mild as to escape observation. In either case, the brain abscess is not suspected until operation or autopsy reveals the true condition.

The course of the brain abscess which has been cited has been that with the more obscure symptoms. Fortunately the symptoms of the abscess are not usually as obscure as the above data would indicate.

There are usually constitutional symptoms of infection, a slight rise of temperature, and rapid pulse. The effect of intracranial pressure caused by the abscess gives a paradoxical symptom of rising temperature and falling pulse rate, which is pathognomonic of cerebral abscess. The polymuclear leucocyte percentage is sometimes increased. Together with these symptoms, the fundus oculi occasionally shows choked disk with neuroretinitis. In doubtful cases daily retinoscopic examinations are desirable for the detection of the rapid changes which often occur. Symptoms of cerebral irritation may be absent or marked, from a slight irritability of the patient to delirium and coma. Brain abscess is usually associated with increased tension of the dura mater, which is demonstrable by palpation after exposure through the calvarium.

The course of the abscess, if without treatment, varies with the extent and virulence of the infection. In the mild case of infection, a small or moderate sized abscess is formed with thick enveloping capsule, which in a few cases finally becomes cicatrized or calcified. More often the mild infection remains encapsulated for an indefinite time or until lowered constitutional resistance can no longer oppose the spread of the infection. Meningitis soon follows, with extension, ending finally in death. In the virulent infections, the area involved rapidly spreads, often progressing too rapidly for pus formation. Cerebrospinal meningitis soon develops and death quickly follows.

**DIAGNOSIS.**—The diagnosis of temporo-sphenoidal abscess is positive in cases where there is aphasia with middle ear suppuration. It is presumptive in cases of middle ear inflammation if there are symptoms of intracranial pressure and constitutional symptoms of infection which are not explained by the presence of meningitis or thrombosis.

In some cases the diagnosis of the existence of temporo-sphenoidal abscess cannot be made until the dura mater has been inspected after an operation for mastoiditis when the conditions found have required the exposure of the dura. In these cases, if the dura mater shows a fistulous opening or

suspicious circumscribed patches of granulations, the presumptive diagnosis of temporo-sphenoidal abscess can be made, but the abscess cannot be definitely established until it has been located by puncture.

If, when local convalescence has followed a successful mastoid operation, the patient still has lingering headaches and slight constitutional symptoms of infection, with or without demonstrable intracranial pressure symptoms, and without aphasia, we may safely conclude that either meningitis or brain abscess is present. With meningitis, the symptoms are more marked and the disease runs a shorter course than with brain abscess, which usually has obscure symptoms and progresses very slowly.

There are on record cases of sphenoidal abscess which were found without the presence of any middle ear infection. The diagnosis of such cases *intra vitam* is very difficult. If there are intracranial symptoms referable to the cerebrum in any way suggesting brain abscess with normal tympani, the history of the case is of extreme value, since a history of suppuration, even though it be a long time previous, is a strong presumptive proof of the presence of temporo-sphenoidal abscess.

**TREATMENT.**—The treatment of temporo-sphenoidal abscess consists in surgical drainage, and removal of the infected tissues.

**TECHNIC.**—The mastoid operation should precede the intracranial operation, in order to more conclusively confirm the diagnosis of intracranial abscess, which follows the discovery of fistulous tract and intracranial extension of necrosis. The mastoid operation serves also to remove the peripheral cause of the central infection and to open the route of drainage.

When we determine that drainage from the lowest part of the wound will be necessary, we can dispense with a trephine opening or an osteoplastic flap in the temporal fossa.

This lower drainage is obtained through the aperture in the skull made by the extension of the mastoid operation, and if we enlarge this cranial opening we obtain all the advantages of upper and lower openings, with the addition of a simplified technic. The best technic for opening the abscess is to continue to extend the primary mastoid operation and uncover a large area of dura mater over the location of the abscess.

This gives opportunity of placing the drainage in the most dependent part, which will give better results than an osteoplastic flap at a higher level.

After performing the mastoid operation we follow the route of infection, open the cranial cavity and enlarge the opening along the floor of the middle fossa by removing the tegmen, the upper wall of the external meatus, and as much of the adjacent squama as is necessary to uncover the seat of the abscess.

The next move is to locate the abscess. In some cases the abscess can be located by focal symptoms; in others, by fistulae or necrotic areas, and if these two methods are insufficient, by the use of an aspirating needle and syringe, testing the temporo-sphenoidal lobe in all directions for pus.

When finally the abscess is located, it must be evacuated by an x-cut in the dura mater, sufficient to expose the whole area of the abscess. The cut is carried throughout the outer wall of the abscess with a sharp knife.

Great care must be taken to sterilize the wound before opening the dura mater with a sterile knife. The best method of sterilization is by careful syringing and mopping with salt solution.

In the early stages of the abscess, before the formation of pus, there is little to be evacuated; in more advanced abscesses, the pus will be forced out through the free opening by the intracranial pressure.

The next point is the maintenance of drainage. In the serous and necrotic stages of the abscess, and before the formation of the capsule in the suppuration stage, sufficient drainage is accomplished by thoroughly exposing the infected area. There are two great difficulties in obtaining drainage of a brain abscess: (1) The tissue is of a very soft consistency, and is, therefore, liable to be injured by any resistant drain. For this reason it is better to use soft tissues such as rubber tissue or gauze, and to avoid packing. When the great depth of the wound demands more collapsible drainage, decalcified bone tubes are the best. (2) The tissues, because of their soft consistency, have a tendency to collapse and to close the wound too readily, thereby obstructing drainage. For these two reasons, the best results are obtained by making large exposures and extensive incisions. Under these circumstances, less depth

of drainage is necessary since the surface drainage is more effective.

In old abscesses, with thick encapsulating walls, the contents must be evacuated before drainage can be inaugurated. The thick contents of these abscesses can be extruded only through the wide incision of the external wall, and the cavity is cleaned with peroxide of hydrogen and lightly packed with gauze, which is placed so as to widely distend the opening.

The post-operative care of the wound requires scrupulous antisepsis to prevent the spread of the old infection and the entrance of new organisms. In order to assist drainage, the wound may require two or three dressings daily. The wound should be kept open as long as possible to maintain drainage to the utmost. Even after the wound is completely healed, the patient is still in great danger of recurrence, and should therefore be very careful in his habits, especially avoiding the increase of blood pressure and cerebral congestion. The patient should be kept under observation for a year or more, in order that the least unfavorable symptom may be noted.

The question of brain hernia always has to be considered in connection with operations on brain tissue. The occurrence of hernia suggests increased intracranial pressure, which it tends to relieve. If hernia occurs, effort should be made to have it extrude the abscess. To accomplish this, compression is applied over the exposed brain, leaving the outer wall of the abscess unprotected.

**PROGNOSIS.**—From the author's experience, the prognosis for cases taken early in the brain infection is recovery for over 50 per cent; for complicated cases, and for those seen late, the mortality is very high. Without operation, the disease is almost always fatal.

The prognosis for perfect recovery and regeneration of cerebral function is good for the cases where the functional impairment is due simply to pressure or to inflammation, but bad for cases where the functioning areas are destroyed by necrosis or suppuration. The general health and cranial condition are not good for several years after convalescence, even in the best cases; in some cases, the patient may remain an invalid.

Causes of death from brain abscess are meningitis, septicemia and intracranial pressure.

**SUMMARY.**—The diagnosis of temporo-sphenoidal lobe abscess is often obscure, but suggestive symptoms are always present, and confirmatory ones can always be found on careful search. The treatment is operative drainage. The technic of the operation is directed to extensive exposure and incision of the infected area, to allow free drainage, with economy of drain. The tympanic route for drainage is selected because of its technical convenience and because of its dependent position.

## XXVIII.

### REMOVAL OF THE TONSIL (COMPLETE) IN ITS CAPSULE.

A DESCRIPTION OF THE TECHNIC OF THE OPERATION,  
POSITION, ETC. (ILLUSTRATED).

By FRANK C. TODD, M. D.,  
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Surgery of the ear, nose and throat was slow to take its place in the advance with general surgery. Only very recently has it stepped into the front ranks with the latter. No wonder then that many continue to practice in the old-fashioned way.

The main reason rhinologists and laryngologists have lagged so far behind their brother surgeons, is that they began wrong. Specialists in ear, nose and throat diseases at first were not surgeons, but physicians treating diseases of those organs. Had they begun with the proper knowledge of the principles of surgery, they could not have failed to see the mistake they were making in attempting to cure a mastoid abscess by incomplete and improper drainage or chronic suppuration of the middle ear with necrosis, by medication. Certainly they could have appreciated that the slicing of a portion of a diseased tumor from between the pillars of the fauces was poor surgery. Such practice upon any other such tumor existing elsewhere in the body would be condemned.

This apology for the tardiness in the advance of our surgical work seems necessary. A further discussion as to the advisability of doing a complete tonsil operation, however, would be to admit the present existence of this failing, for to-day the man who does not attempt to remove the entire diseased tonsil manifests poor and antiquated surgery.

Having finally agreed upon this principle, it remains for each of us to determine what would seem to be the best method of accomplishing the desired results. The removal of the entire tonsil in its capsule leaving intact its bed of muscular tissue and the fauciæ pillars uninjured, gives the best ultimate results. But if the muscle tissue is torn or otherwise materially injured, or the pillars are greatly dam-

aged, or portions of the tonsil remain to form adhesive bands between the pillars and to continue the disease process, then the results are not the best that can be secured and may even bring about such cicatricial contraction as to interfere with the normal action of the muscles thereby causing discomfort and disturbance. And yet it is evident that considerable traumatism to these structures may take place and the results be good, even though not ideal. As throat surgeons, however, it is our duty to try to bring about ideal results and to so perfect our technic as to accomplish this end.

As early as 1897 the writer became convinced of the advisability of the removal of the entire tonsil. At first an attempt was made to bring this about by the use of forceps, drawing the tonsil into the tonsillotome. Difficulty arose from the resulting hemorrhages, which were not lessened upon substituting various forms of scissors. Removal by cauterization, after trial was abandoned for obvious reasons. Early attempts were made to remove the tonsil in its capsule by the use of a dull periosteum elevator, with success only in those cases where the tonsil was very firm.

During this process of evolution tonsillotomy was gradually eliminated from the practice of the writer and the technic changed until the method described below was worked out. The operation of complete removal of the tonsil has been practiced by the author many times and is here described for whatever it may be worth.

#### METHOD OF OPERATION.

Position:—When done under local anesthesia, the patient may remain upright. The tonsil may often be anesthetized by wiping cocaine with cotton tipped probes well into the crypts. Under a general anesthetic the patient should be placed in such a position that the blood can not flow into the larynx, for this, I believe, is practically the only danger of this operation.

The position which is used by the writer during general anesthesia as applied to this operation was so far as he knows original with him (See figures 1, 2, 3, 4 and 5). It has been in use for eleven years. The patient (No. 1) is laid upon his back on a flat table and the head bent backward and downward at a right angle over the edge, the inverted

face looking directly at the surgeon. The nurse (No. 2) sits upon a low stool (about six inches high) on the left side of the patient, holding the jaw forward to facilitate breathing, it being found that when the tongue depressor is inserted breathing is sometimes obstructed. The anesthetist (No. 3) stands by the side of the patient's body (on the left side), administering the anesthetic, watching the patient and assisting in holding the jaw forward, while the surgeon's assistant (No. 4) stands upon the right side of the patient, near his body, holding the tongue depressor in his right hand and being ready with his left hand to swab out whatever blood collects.

It will thus be seen that the head is in such a position that whatever bleeding takes place must run out of the nose or into the roof of the mouth, but can not run up hill into the larynx. The table being properly placed, daylight may be utilized, shining directly into the mouth from above on each side of the operator (No. 5), who sits upon a stool in front of the patient's face. The Whitehead mouth gag is used because it stays in place and is always out of the way. In this position with assistants also placed as described, a splendid view of the field of operation is secured and quite a number of observers may stand behind the operator and view the operation, while the operator is secure in feeling that he will not choke his patient and he can work with celerity.

Technic.—With a pair of dull serrated forceps (Figure 6) the right tonsil is grasped (these ring forceps do not tear through the tonsil as is the case with pronged forceps, though the latter are better if the tissue is very soft), the dull dissector, shown in Figure 7, is then used to peel the tonsil out from its bed at the upper angle, in front, and below. By pushing the pillars back the tonsil will leave its bed and the separator can even be used with facility in suitable cases to completely remove the tonsil in its capsule.

The snare is next introduced over the right tonsil, the tonsil again grasped with the tonsil forceps and pulled out into the snare. Being really attached only by a pedicle to the posterior pillar it can be readily removed as the snare is slowly brought through, care being taken before closing the snare to so thoroughly sponge the blood and secretion away as to allow a good view, because of the possibility of accidentally engaging the uvula in the snare.

Hemorrhage:—It will thus be found that excessive bleeding does not take place in this operation, because dull instruments are used exclusively and care is taken not to injure the pillars. If bleeding however does take place it may come from one vessel; search should be made for the bleeding point which should be grasped with the artery forceps, usually a twist will be sufficient to stop it, though it is not a difficult matter to tie it off. More commonly the bleeding is a general oozing; if so, it may be quickly stopped by pressing a sponge-holder grasping a piece of moistened gauze, covered with tannic acid powder, against the bleeding surface. If necessary this procedure may be repeated several times.

Usually no delay is necessary, especially if the operator has been careful in his technic, and he may proceed at once with another snare already prepared and remove the remaining tonsil. No further anesthetic being necessary, he quickly proceeds to the next step which consists in performing adenectomy. The operator (No. 5, figure 5) standing, places his left forefinger in the mouth pulling the pallet forward and feeling the adenoids and the structures of the postnasal space with that finger. He then inserts a (right) curette (Figure 8), the blades of which are slanting to more effectively cut and with one clean sweep severs the mass. Following this the other (left) curette is inserted, this going back into the posterior portion of the nares on the other side. A dull ring side scraping curette (Figure 9) is then used to scrape the remaining remnants in the vault and in the fossa of Rosenmueller, the operator still using the left forefinger as a guide to determine whether or not more adenoid tissue is present. Finally a piece of gauze wrapped over the right forefinger is inserted into the vault and the whole area rubbed with this rough gauze. The position of the head during the adenoid operation remains the same, the nurse holding the jaw in place with the assistance of the anesthetist, and the surgeon assistant holding the patient, who at this time may be struggling, though insensitive to pain.

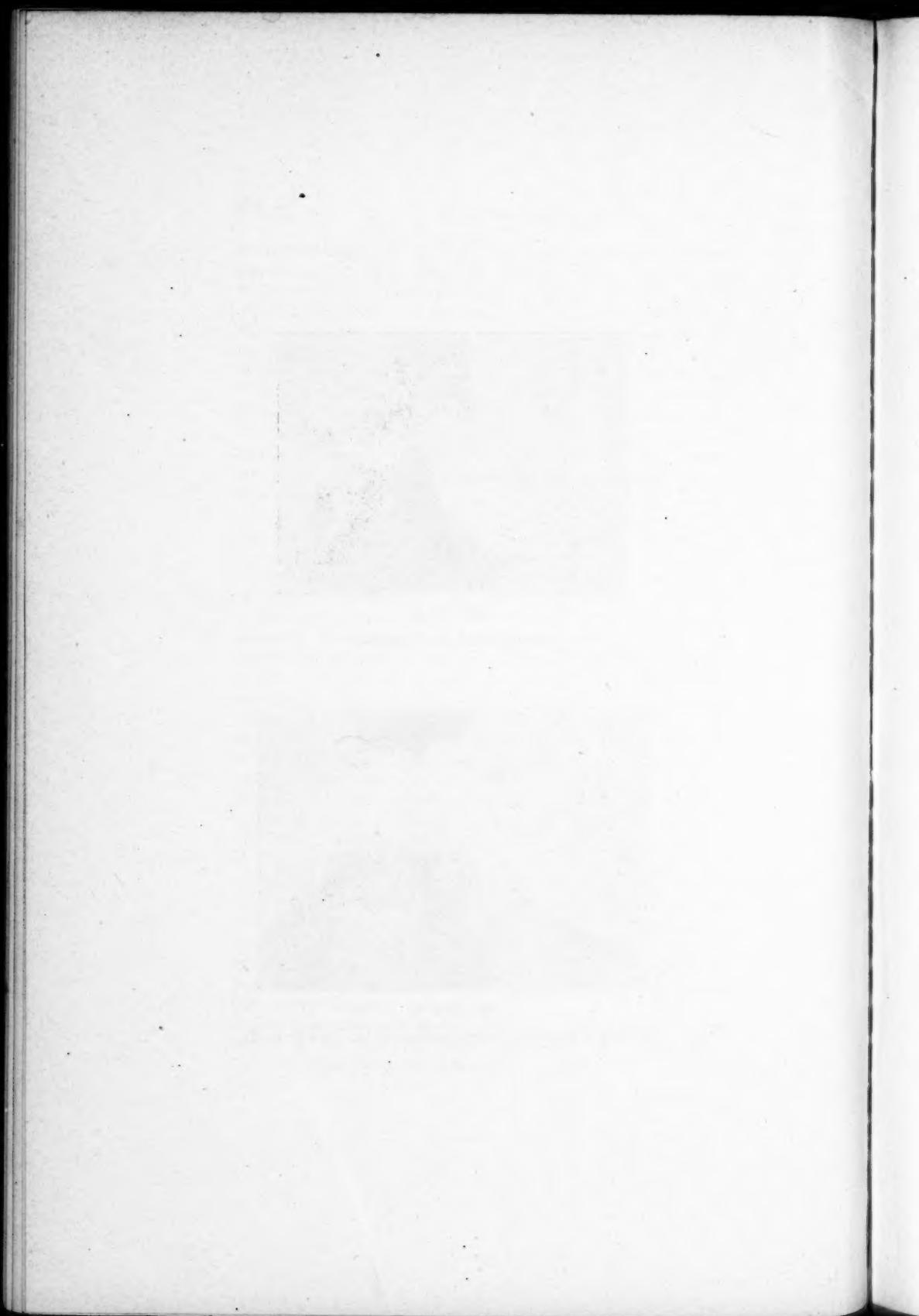
The operation now having been completed the patient is turned on his face, the head allowed to drop some over the end of the table until bleeding has ceased.



FIGURE 1.  
Administering the anesthetic.



FIGURE 2.  
Mouth gag in position, nurse holding angles of jaw forward.



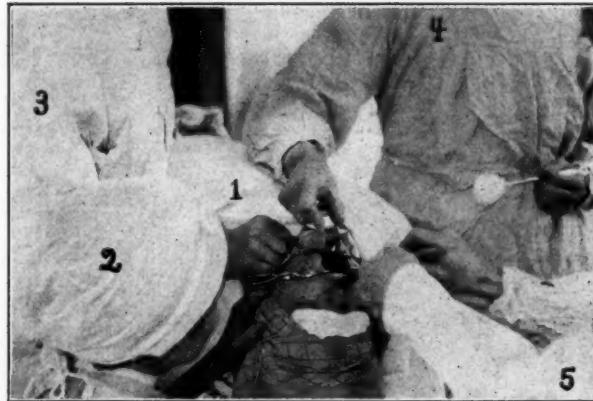


FIGURE 3.  
Dissecting tonsil.

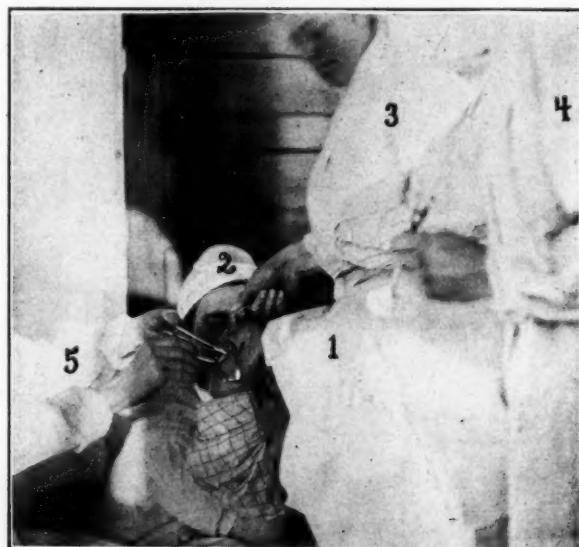


FIGURE 4.  
Side view during dissection of tonsil.

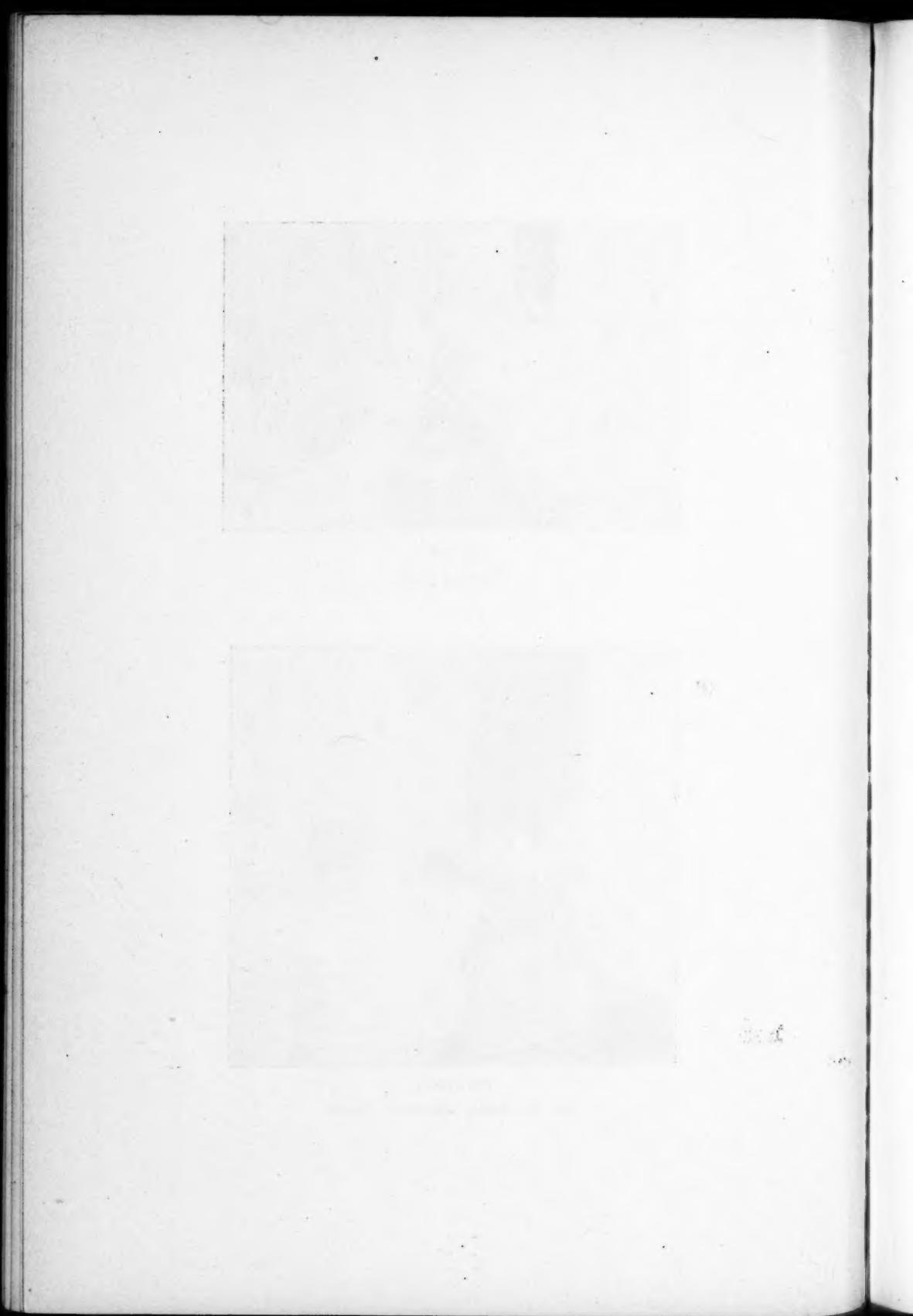
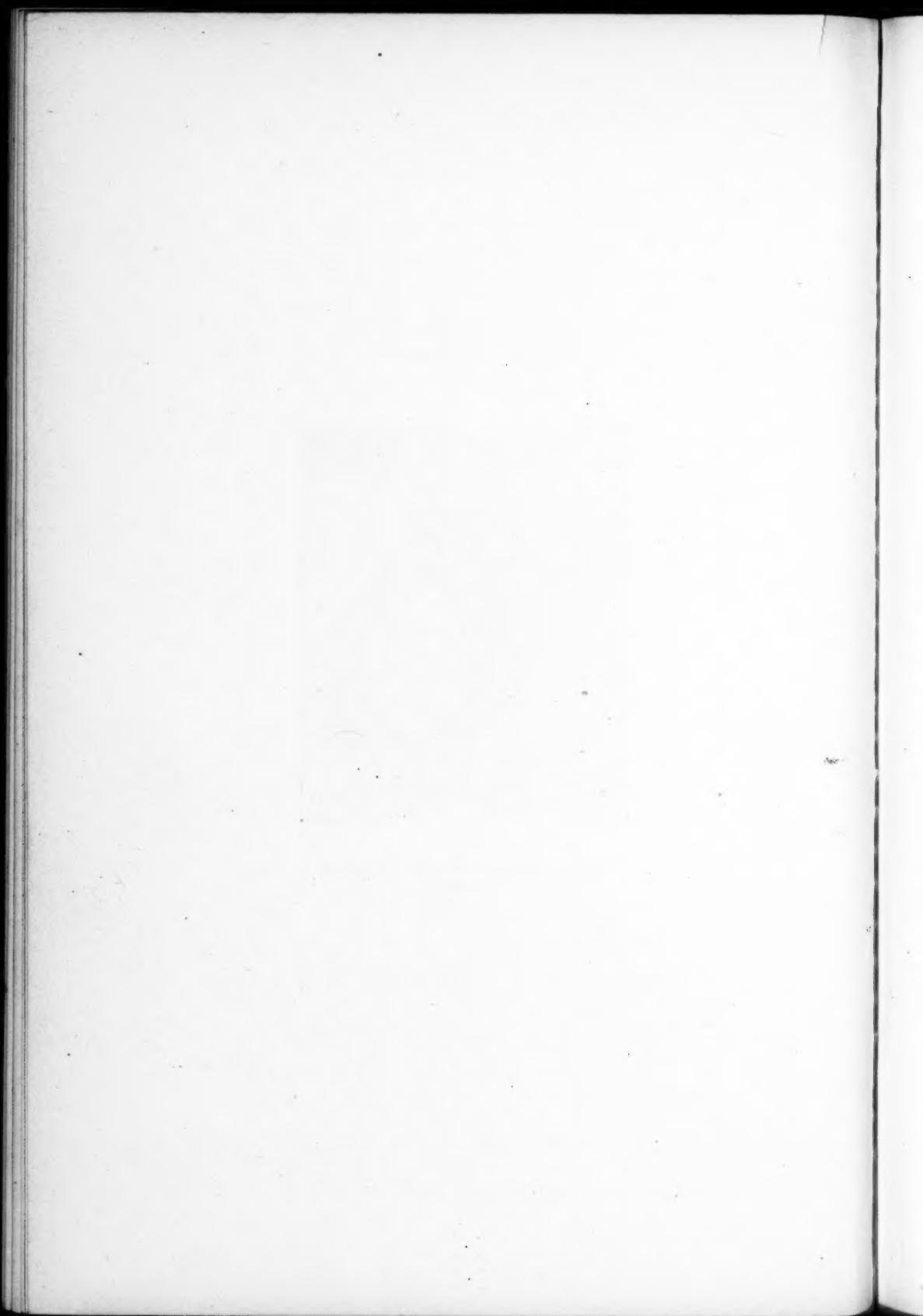




FIGURE 5.

Removing adenoids, left forefinger pulling  
pallet forward and feeling adenoids.



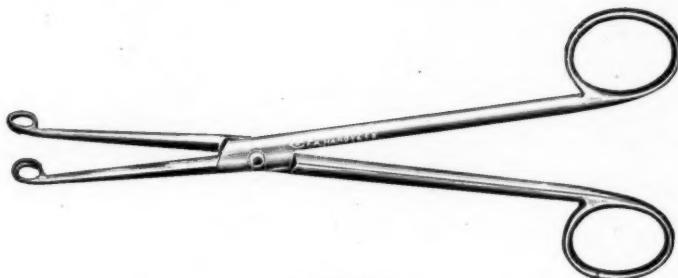


FIGURE 6.  
Author's Serrated Ring Tonsil Forceps



FIGURE 7.  
Author's Dull Tonsil Dissector.

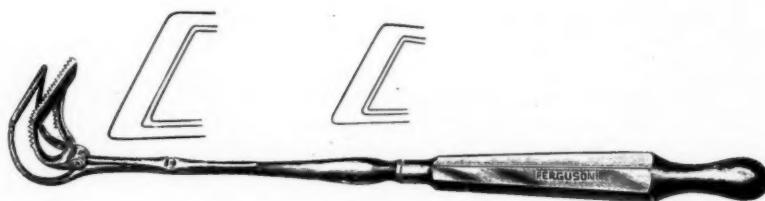
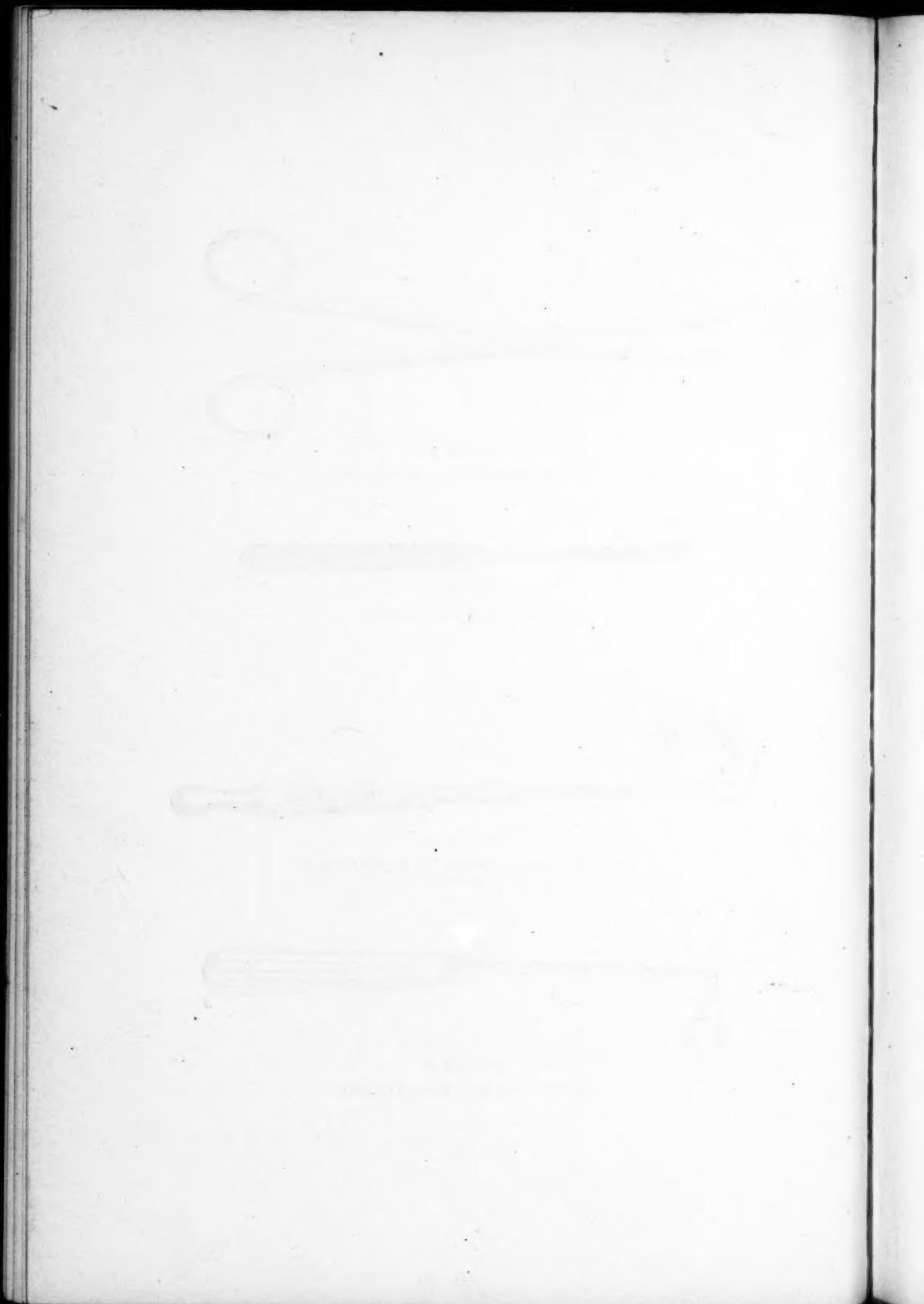


FIGURE 8.  
Author's Adenoid Curette with Tooothed Clamp  
(made in rights and lefts).



FIGURE 9.  
Krause's Dull Ring Adenoid Curette.



## XXIX.

### A METHOD OF PRECISION FOR INFLATING THE TUBE AND TYMPANUM.

BY THOMAS HUBBARD, M. D.,

TOLEDO.

Politzerization has been practiced for more than half a century and the original method is still quite unanimously approved by otologists. For purposes of diagnosis and treatment the air bag is probably the most commonly used article in our armamentarium. It has survived most of its contemporaries, and chiefly because of its harmlessness as well as simplicity of construction and operation. I wish to impress the conviction that any safe and successful method of tympanic inflation must embody the essential features as described by Politzer in 1863. There is, however, opportunity for improving certain mechanical deficiencies of the original apparatus without verging on the impractical or sacrificing the feature of safety. This brings me to mention some of the defects of the ordinary method. The volume of air is small and the act of inflation so brief that the operator has scant opportunity for utilizing delicacy of compression and is rather compelled to depend on the natural safety valve, the velum, to guard against producing too high tension in the nasal cavity and tympanum. Some prevent overtension by releasing the fingers holding the nostrils. Every practitioner must have had the impression that the method would be more effective if he had a larger volume of air under compression. The larger the volume the greater the elasticity and the more positive and effective the inflation with comparatively less tension. The lower the tension the better opportunity for delicacy of manipulation. One might make comparison with the use of large and small syringes for aural irrigation. With a large syringe the operator can control and use a gentle current more effectively than with the high pressure current from the small syringe.

A strong hand can compress the Politzer bag up to about two-thirds of an atmosphere, but as a matter of fact only one-tenth to four-tenths of this tension is applied within the nares and tube. It is evident that there is scant opportunity for exercise of delicacy of touch when there is such disproportion between force exerted and the actual applied tension. It scarcely requires further argument to prove that with a large volume of air having the features of elasticity and reserve, the same dilating and cleansing force can be applied with greater delicacy and precision than obtains with the ordinary method, and that too with a lower degree of tension.

This must not be considered an endorsement of the method of using the air direct from the compressed air tank for inflation. In fact I wish to express a caution against this procedure. It is too much like attempting to modify the street current for purposes like electrolysis. The method which I advocate may be compared to the storage cell system, the compressed air for inflation being drawn directly from an intermediate reservoir of definite known tension.

The purposes of inflation are three-fold: (1) To restore normal tension, (2) to restore anatomical relation, (3) to cleanse tube and tympanum of accumulated secretions. In acute conditions the establishing of normal air tension is chiefly trophic as to therapeutic effect. Incidentally sound transmission is improved, and drainage and absorption of inflammatory exudates encouraged. The degree of resistance to inflation is in this condition an unknown factor. It depends largely on the tubal congestion and amount of mucus at the mouth of the tube. It is certainly irrational to assume that it is safe to use the maximum of force, that is, as much as the safety valve (the velum) will permit, in these acute conditions. Painful Politzerization is not justifiable. It often means an acute exacerbation of inflammation. The indications are to inflate with the least possible pressure, and thus restore physiological conditions. In subacute and chronic states the object of inflation is to restore normal tension, to break up adventitious adhesions, relieve venous and lymphatic stasis and encourage absorption and drainage. If there be a perforation it is obvious that a sustained air current through the tube is indicated. The popularity of the catheter method can be ascribed in part to the fact that ordinary Politzerization is not effective for this purpose.

With these indications clearly in mind: gentle inflation in, or rather following, acute otitis; carefully regulated sustained or intermittent pneumo-massage effect in subacute or chronic conditions, the problem is to so modify the Politzer method as to meet the requirements.

In 1893, in *Archives of Otology*, I described this apparatus. It does not seem to have made much of an impression and I venture to call attention to it again with increasing confidence in its practicability and precision.

**DESCRIPTION OF APPARATUS.**—The *regulator* controls the tension of the air delivered at the *cut-off*. Twenty to twenty-five pounds is a fair working pressure. Between the *regulator* and the *pressure gauge* is an *air-filter* packed with cotton containing camphor-menthol crystals. The *clamp cut-off* (wrapped in gauze) is held in the same hand with the *Politzer air bag*, which latter and also the *nasal tip* is connected by tubing with the *air reservoir*. The *manometer* registers the maximum degree of tension in the whole system and when in actual use it must record the maximum pressure in the nares and tympanum. There is an uncertain factor of resistance at different points of the system and the operator cannot determine the actual tension within the tympanum during a momentary inflation, but he can be certain that it is not greater than the manometer indicates. As a rule the inflation is prolonged sufficiently to give an accurate reading of actual tension within the tube and tympanum, and further by intermittent pressure of air bag an effective degree of pneumo-massage can be applied. The Politzer airbag held partially compressed in the hand is the safety valve of the apparatus and can be manipulated with a delicacy of touch adapted to degree of resistance, and special indications, such as the age of patient and stage of inflammation.

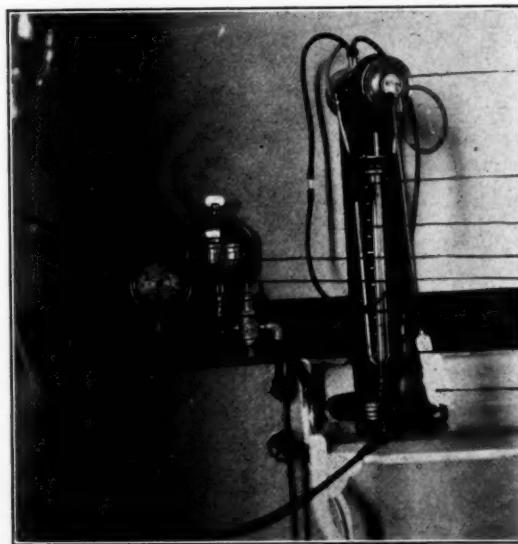
The essential features of this apparatus are, sterile air under known tension, a reservoir (2 liters) with manometer attachment insuring the proper degree of elasticity in the volume under compression, and the cut-off and Politzer air bag under perfect control of the hand.

The special points to be observed in construction are that the cut-off must be one permitting the passage of a generous flow of air, the old fashioned clamp type being the best, and a free calibre of tubing and connections must obtain throughout the

system. The large bulbous nasal tip of size adapted to the age of the patient is advised.

Clinical experience impresses me that the usual estimate of pressure applied in inflation is rather high. A degree of tension represented by 4 to 10 inches of mercury in the manometer is the ordinary pressure used, the same being about one-eighth to one-third of an atmosphere, or 2 to 5 pounds.

I have purposely omitted mention of the use of medicaments as this paper is concerned chiefly with the physical problems. It is very easy to impregnate the air with camphor-menthol or antiseptic vapor such as formaldehyde, and further, the air in the reservoir can be heated to a definite temperature by the insertion of an electric lamp of low candle power.



Air Reservoir

Nasal Tip

Manometer

Air Filter

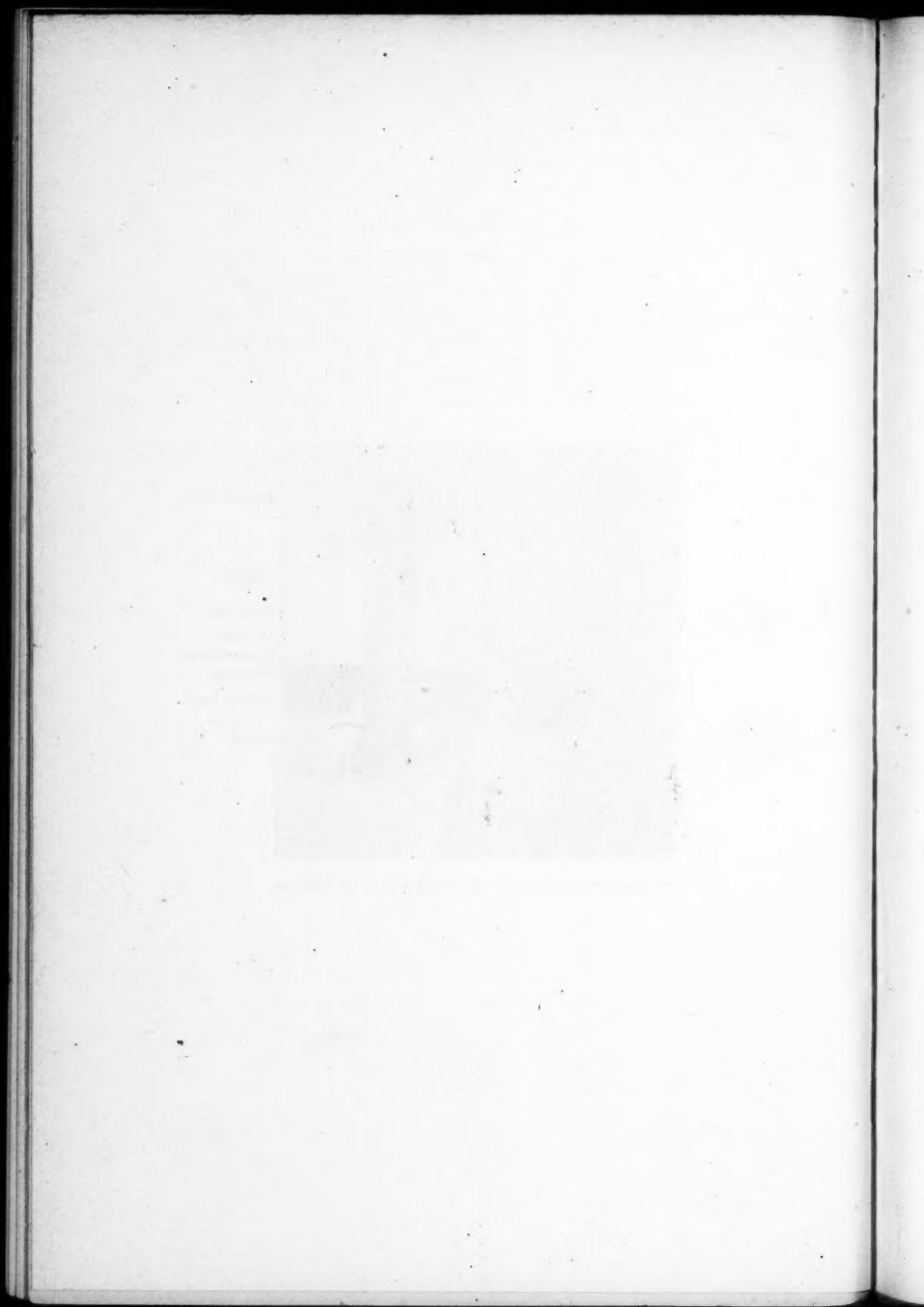
Pressure Gauge

Regulator

Politzer Bag

Cut-Off

An Apparatus of Precision for Inflation of the Tympanum.



XXX.

METHODS OF OPENING THE MAXILLARY ANTRUM, WITH PRESENTATION OF A NEW INSTRUMENT.\*

BY JOHN O. ROE, M. D.,

ROCHESTER.

It is a well recognized fact in medicine that the more obscure the etiology of a disease, the more intricate the diseased structures, and the more complicated their anatomical relations to other parts, the more numerous and varied will be the remedial measures proposed for its relief or cure. This is very well illustrated in the varied medical and surgical measures that have been brought forward for the treatment of accessory sinus diseases. It is a matter of daily observation that when the exciting cause of a disease is removed the disease itself often speedily disappears—*sublata causa tollitur effectus*. Nature effects a cure if the normal functions of the part are not too seriously interfered with. This restorative tendency, this *vis medicatrix naturae*, is to be observed in the case of diseases of the maxillary antrum as well as in diseased conditions of any other part of the body. This is due to the fact that diseases of the antrum are almost invariably secondary to diseases of the associated structures in the nose that obstruct its ostium and interfere with its normal functions and cause infections to extend to its cavity.

It is, therefore, of the utmost importance before attempting an operation on the antrum itself for the cure of an empyema, to carefully investigate the structures in the immediate vicinity of the hiatus semilunaris and the infundibulum, that may be regarded as the gateway to the different sinuses. This region has been appropriately termed by Ballenger "The Vicious Circle," although, as there is no circle involved, I think the term vicious center would be a name quite as appropriate for

\*Read before the American Laryngological Association at its thirteenth annual meeting, held at Montreal, Canada, May, 1908.

this region. This is a particularly vicious center, for there is no region of the body in which the anatomical conformation is subject to such infinite variations as the cellular structures of the nose. It is this variation which accounts for the fact that a disturbance in the same location will in one case produce most serious results, while in other cases the effects will be but slight.

Moreover on account of these great anatomical variations, the direction of the drainage of the different cells is by no means constant, and, consequently it may be very readily diverted from its proper channel. It has been shown by Zukerkandl, Logan Turner, Wright, Myles, Cryer, Killian, Jansen and others that obstruction of these channels, and particularly of the infundibulum, may divert the discharges from the frontal sinus or ethmoidal cells directly into the antrum. It is, therefore, readily seen that in case of disease of the frontal or ethmoidal cells the antrum may become the innocent receptacle of infectious discharges. When the antrum has been so long a reservoir for such discharges as to become the seat of an independent disease, which nature is unable to cure on the removal of the exciting cause, irrigation and medication through the ostium maxillare should be resorted to. If these measures fail, the opening of the antrum becomes a necessity.

The four well-known routes by which such an opening is made are through the alveolar process, the canine eminence or canine fossa, the hard palate and the naso-antral wall.

In those cases in which the exciting cause of the antral trouble is a diseased tooth penetrating the floor of the antrum, the extraction of the tooth and the free opening of the antrum through the tooth socket, through which opening the antrum can be thoroughly irrigated and medicated, will, in many cases, if the disease has existed for but a short time, speedily cure the affection. In all such cases, however, in which the disease does not speedily yield, other methods should be employed. The very old and common practice of inserting a permanent canula through the maxilla to drain the purulent discharge into the buccal cavity is not only ill advised, but can not be too strongly condemned.

The opening through the roof of the mouth is only advisable in certain cases for the removal of growths which are so

located as to make this route the most direct method of reaching them.

In making the opening through the anterior wall of the antrum the Küster operation, which consists in taking away a sufficient portion of the wall to permit a free examination and exploration with the finger, and the Denker operation, which is simply an enlargement of the Küster, opening forward to the anterior angle of the sinus so as to render this portion of the cavity entirely accessible, are those commonly employed.

In those cases in which the entire chain of cells is diseased, the antrum, the ethmoidal cells, the frontal sinus and in many cases the sphenoidal sinus also, Jansen has proposed the extensive external operation of laying open the entire chain. This operation is only called for and only warranted in extreme cases in which the cavities are the seat of myxomatous or other growths. In all ordinary cases of empyema of the antrum and ethmoidal cells, associated with nothing more than a degenerated condition of the mucous membrane that has resulted from a prolonged maceration in pus, these external operations are, in the opinion of the writer, unnecessary, for the reason that diseased conditions of the maxillary sinuses, and also of the ethmoidal cells which are commonly associated with an empyema, can be successfully treated by the nasal route. I simply mention these methods for the purpose of comparison, in order to emphasize the advantages of the nasal route over all other methods in the treatment of such conditions.

As a combination of the external and internal routes, Caldwell, of New York, in 1895, described a new method by which an opening is made into the antrum through its outer wall sufficiently large to inspect the cavity and to remove any growths that may be found. When this is done the opening is then continued through the naso-antral wall into the nose, through which the subsequent cleansing and treatment of the cavity is carried on, the external opening being immediately and permanently closed. Two years later Luc, of Paris, without a knowledge of Caldwell's operation, performed and described exactly the same procedure and so strongly advocated the operation that it has since been called "The Caldwell-Luc Operation."

This same operation is also advocated by P. Watson Will-

iams; but instead of using a chisel for making the opening through the different bones, he employs a "six-penny trephine" with a gimlet-pin, making an opening into the antrum corresponding to the canine fossa. A circular opening is then made with the same trephine through the naso-antral wall just behind the anterior end of the inferior turbinate body close to the antral floor, removing at the same time the corresponding portion of the inferior turbinal. Through this opening the necessary treatment of the antrum is applied, the buccal opening being allowed to close at once.

Various methods of technic are employed by different surgeons for opening the antrum through the nose, an operation which was first proposed by Gooch and Réthi, and also advocated by John Hunter. The simplest method is by puncturing the wall with a Krause trocar and canula, an instrument which is sometimes used in this manner merely for the purpose of diagnosis. With it the antrum can be washed out and this is often sufficient, in recent or subacute inflammations, to effect a cure.

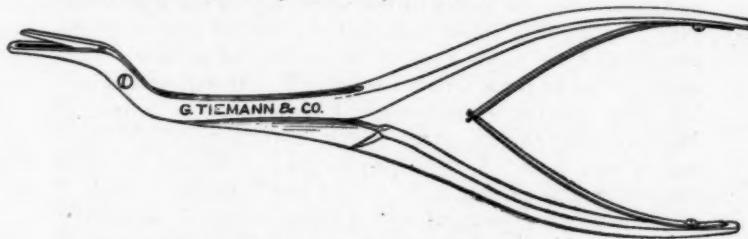
Vail proposed making a circular or oval opening by means of curved saws after having punctured the bone with his perforator, which process necessitates at the same time the removal of the anterior half of the inferior turbinate body.

Ballenger's operation consists in cutting out a portion of the wall either square or of any desired shape or dimension with his right angle knife. His method he describes as follows:

"The knife should be introduced through the naso-antral wall at the posterior limit of the antrum near the floor of the nose; then make an upward cut, a forward and downward cut. The upward and forward cuts are made with the blade of the instrument at right angles to the naso-antral wall. When the forward cut is made the blade should be turned down, parallel with the naso-antral wall and pulled through it. The inferior incision remains to be made, and is done with the reverse knife, the knives coming in pairs. The knife is introduced into the posterior perpendicular incision at the floor of the nose and drawn forward along the floor of the nose to the anterior perpendicular incision, thus completing the removal of the naso-antral wall. Should the knife fail to remove the thickened lower portion of the wall it may be removed with the Grünwald or other bone forceps."

It has not been the experience of the writer to encounter naso-antral walls so readily pared away with the knife as has been my friend's experience, judging from the above description; on the contrary, a large majority of naso-antral walls are very firm below the attachment of the lower turbinate and require, in many cases, considerable force to puncture with a drill or chisel.

The success of the operation by the naso-antral route in the treatment of chronic empyema of the antrum depends upon the freedom of the opening, which should allow perfect drainage into the nose and free access to every portion of the cavity for thorough medication. For this purpose I have devised a pair of cutting forceps (vide cut) with sufficient strength to meet the requirements in every case, however firm and resistant the bony wall may be found.



Roe's Antrum Punch Forceps.

These forceps are made in two forms. One with the male blade entering the antrum, the other with the female blade entering the antrum. The former is preferable when the floor of the antrum is above, the latter when the floor of the antrum is below the floor of the nasal passage.

The technic of my operation is as follows: Owing to the great variation in the size and position of the lower turbinate, it being frequently attached very low down or enlarged or curled so as to greatly limit the space between it and the floor of the nose. It becomes necessary in such cases to remove the lower anterior portion of this body in order to make room for the operation. This is done with a slender, probe-pointed knife introduced beneath the turbinate along its attachment, cutting downward and inward toward the septum so as to catch the scroll as it rolls outward, or with

a pair of scissors or a pair of Grünwald's cutters. A small angular or curved pointed knife is now introduced and an incision made through the periosteum down to the bone from behind forward, covering the entire length of the antrum, and as close to the attachment of the lower turbinate as possible. By examining the conformation of the jaw, assisted in doubtful cases by the x-ray, we can judge quite accurately as to the position of the antrum and its forward projection, at which point the puncture through the bone should be made. At this point the incision through the muco-periosteum is turned downward to the floor of the nose, the incision at the posterior end being also carried downward to the floor. This flap is then raised from the bone, carrying the periosteum with it throughout this subturbinal portion of the wall, and rolled and turned into the center of the nostril out of the way of injury. An opening is then made into the anterior portion of the antrum as close to the floor of the antrum as possible. This opening may be made with a curved drill, a trocar, or a chisel. The most satisfactory instrument I have found to be one of Myle's curved antrum gouge chisels, particularly if the bony wall is very thick. A chisel may be used of the size we wish the preliminary opening to be, or if a small opening is made it can be afterward enlarged with a gouge or chisel sufficiently to admit the blade of the punch forcep. This instrument is now introduced one blade through the opening and the whole wall below the turbinal attachment is removed by nipping it off, a piece at a time. It is quite important that the lower stump of the wall be leveled off so that there shall be no projection between the floor of the nose and the floor of the antrum. Should it be desired to remove a portion of the anterior border of the wall of the antrum, this can be most easily done with Wagener's forward cutting antrum punch forceps. When the lower portion of the wall has thus been completely removed, the cavity is carefully explored and any growths that may be found removed. The cavity is then thoroughly irrigated and carefully dried out. The periosteum and mucous membrane that has been raised from the inner wall is trimmed if necessary and turned down over the stump of the wall and carefully held there by thoroughly packing the entire antrum and also the nasal cavity with iodoform gauze. It is unnecessary to deal especially with the upper border of the incision, as it is thin,

drains freely and readily heals. By thus covering the lower stump of the wall with mucous membrane we have left a uniform mucous surface and a perfectly free opening into the antrum making it practically a recess of the nose. We can now deal with any growths or abnormal conditions which may be present and medicate the cavity as we would any other diseased mucous surface. This conversion of the antrum into a portion of the nasal cavity is never followed by any ill effects nor the slightest discomfort. The practice of vigorously curetting the antrum and destroying its mucous membrane so often recommended in the treatment of empyema of the antrum cannot be too strongly condemned. It is an operation that should only be done as a part of the radical operation of obliterating the antrum by the complete removal of its anterior wall and its lining membrane.

In several cases which I have recently operated upon in the manner above described, the lining membrane of the cavity had become degenerated from long maceration in moco-pus until it was a boggy mass and in many places the bone had become denuded. By giving the antrum free drainage, keeping it clean by frequent irrigation, and stimulating solutions, such as nitrate of silver, the tissues have regained their tone, the periosteum and mucous membrane have become restored, and at the end of four or five weeks the patients were well.

The advantage of this method over other methods is the freedom and ease with which the cavity can be irrigated and medicated, the patient being very readily taught to do the washing himself. Moreover, perfect drainage is maintained by providing a permanent and free ostium to the cavity at its most dependent point. The danger of a recurrence of the empyema is thereby prevented regardless of the infection to which the cavity may be subjected. Finally the necessity of an external operation is avoided except in the case of growths so large as to require the most radical measures for their removal.

XXXI.

REPORT OF A PROBABLE CASE OF SARCOMA OF  
THE SPHENOIDAL SINUS WITH REMARKS.

BY DUNBAR ROY, M. D.,

ATLANTA.

W. W. C., age 56, traveling man, consulted me in March, 1904, on account of some deafness in the left ear which came on during the month previous, as the result, so he thought, of a severe cold. This impairment in his hearing disappeared very slowly. At the time of the cold he was treated by an aurist in another city, but in the physician's endeavor to pass the eustachian catheter into the tube on the left side, so much pain and bleeding was occasioned that the patient ceased the treatment and allowed it to continue as it was until he came under my observation. His past history presented no unusual symptoms. He had always enjoyed good health and had never suffered from any severe spell of illness. In 1885 he suffered from inflammatory rheumatism but that passed away in a short time. He is a moderate smoker and drinker. Absolutely no history of syphilis. During the last winter he contracted a very severe cold and the left ear became affected as stated above. On examination I found the following conditions: His pharynx showed the usual smoker's throat, with the soft palate exceedingly relaxed, so much so, that it was impossible to make a post-rhinoscopic examination without the aid of a palate retractor. The nasal cavity showed nothing abnormal except the membrane over the inferior turbinates was corrugated and thickened. There seemed to be no difficulty in nasal breathing. The catheter was easily passed into the eustachian tube on the right side and that was perfectly free and open. On the left there seemed to be some obstruction in the naso-pharynx which rendered the passage of the catheter rather difficult. However it was used from day to

day with some benefit to the middle ear although the sounds were never clear. The right ear appeared normal. In the left the drum was retracted and the malleus very prominent. Tuning fork heard longer by BC than AC. This was true for all registers. Hearing diminished one-half. The patient was treated for several days with only slight benefit at the end of which time he was compelled to leave the city. I did not see him again until May 1st, two months later, when he again consulted me with the following history: On April 23rd, he noticed some weakness in the left eye and on the 25th he began to see double, which symptom has remained constant ever since. He also has been suffering with severe neuralgic pain in the eye and over the left side of the face and head. Some roaring in the left ear.

Right eye is apparently normal. Vision equals 20/40, with + 1s equals 20/20. Left eye, vision equals 20/40, with + 1s equals 20/20. There is almost total paralysis of the external rectus of the left eye with a consequent homonymous diplopia. Pupil reacts to light and accommodation. The ophthalmoscope shows no change in the disc. In the lower outer quadrant of the fundus there is a small hemorrhagic spot. The veins appear a little larger than normal, but there are no signs of a papillitis. This eye appears to be more normal than the right, as far as its ophthalmoscopic appearances. By shrinking the tissues in the left nasal cavity, the naso-pharynx can be seen and at this point there is a decided bulging, especially as you look towards the vault. On touching this swelling with a probe it appears firm and bleeds very easily. It does not however interfere with nasal respiration. It is practically impossible to pass the eustachian catheter into the tube on this side. The patient was placed upon large and increasing doses of potassium iodide and all smoking and drinking interdicted.

May 5th there was a decided exophthalmos and total paralysis of the external rectus muscle. Pain in and around the eye has been quite severe. There is a slight ptosis. The urine was examined and found to contain albumen and some hyaline casts. The patient was now placed in the hands of a neurologist and I continued to see the case in conjunction with him. About May 12th the patient was placed in a hospital where he could have better attention. This change was

found to be of no benefit, as he began to have marked mental hallucinations almost amounting to a raving, inability to sleep and absolute dread of his surroundings. Consequently he was removed to his daughter's house where he was satisfied to be nursed by an old colored servant whom he had known in his childhood. The exophthalmos increased, the facial nerve on that side began to be affected, his memory failed and nights were made hideous by these delusions. He was gradually growing weaker and at no time was there any further fundus lesion and his vision seemed to remain good. Under treatment his kidneys became more active and the albumen disappeared entirely from his urine. Pain continued to be severe deep in the orbital cavity. There is no apparent change in the naso-pharynx. During all this time he was taking as high as 75 grains of the iodide three times daily. The neurologist was under the impression that there was possibly a tumor on the posterior part of the orbital plate, extending backwards and upwards into the frontal convolutions. He advised an exploratory craniotomy. Accordingly this was done by Dr. Nicolson about the middle of June. Absolutely nothing pathological was found although Dr. Nicolson explored with his finger all the upper surface of the orbital plate. Patient rallied well from the operation and for a few days seemed to improve, probably due to the lessening of the intracranial pressure. The pain was much reduced. At no time was there any trouble with the proper functions of the bladder and bowels. There was no paralysis or paresis in any other portion of the body. No difficulty in deglutition. His appetite was poor and the patient gradually became weaker. His mental symptoms, while not so marked as previous to the operation, were decidedly noticeable. One week after the operation the patient died in convulsions which were diagnosed as uraemic. Unfortunately no post-mortem could be obtained. The history of this case is exceedingly interesting and at the same time somewhat obscure. Two facts are clear: (1) There was evidently a tumor (probably sarcoma or epithelioma) at the base of the brain involving at least the body of the sphenoid and encroaching upon the inner extremity of the orbital cavity. (2). There was also present symptoms of a chronic nephritis. Whether the simultaneous occurrence of these two conditions were accidental or stood in some relationship to

each other we are in no position to deny or affirm. Both conditions being recognized about the same time, it was naturally impossible to say which originated first.

In this case all the most prominent symptoms could be referred to a sphenoidal growth and in fact these were the symptoms complained of by the patient, the renal trouble seemingly produced no inconvenience as far as could be elicited by the history. The first real symptom complained of by the patient was a roaring and difficulty in hearing out of the left ear. This he attributed to a severe cold and was so treated by an aurist who however was unable to pass the eustachian catheter on that side. This in itself was suggestive of the beginning of the growth in the sphenoidal cavity, pressing downward and to the left against the eustachian tube. Not improving, the patient consulted me one month later for the roaring and deafness in the left ear. A bulging in the naso-pharynx was then noticed and also the impossibility of passing air through the eustachian tube either by the catheter or the Politzer method.

On May 1st the patient returned with no relief in the ear symptoms with a paresis of the external rectus and exophthalmos of the left eye. Five days later there was complete paralysis of the left external rectus, some paresis of the facial nerve on the same side, marked exophthalmos, bulging more marked in the naso-pharynx, bleeding easily when touched and also severe pain around the left orbit and the same side of the head. A sarcoma or epithelioma in the sphenoidal sinus would produce just this train of symptoms. The sixth nerve comes from the medulla, bends over the posterior end of the pons and runs along in an exposed manner for some distance. For this reason neurologists tell us that this nerve is the one most frequently affected after traumatism and from the pressure of tumors at the base of the brain. The fibres of the seventh are very close to the sixth and close to this are fibres of the eighth, or auditory nerve. Slight pressure on both of these would produce some paresis of the muscles on the same side of the face and some tinnitus in the left ear from the same cause. The tumor also encroaches upon the apex of the orbit as was manifested by the exophthalmos, not however involving the optic nerve nor any other of the motor nerves of the eye. This latter symptom led me to the conclusion that the tumor originated in the sphenoid cavity as a center rather

than in some portion of the brain, since clinical and pathological observation has shown that even sphenoidal and posterior ethmoidal cells may be the seat of an adventitious growth and yet the optic nerve show no symptoms of involvement. On the other hand, a tumor of the brain substance is more than likely to show some papillitis or stasis in the appearance of the optic disc, and this nearly always bilateral. As an aid to making a diagnosis of the brain tumors from the appearance of the fundus, Dr. Byrom Branwell, in his book on *Intracranial Tumors*, has this to say: "The absence of double optic neuritis does not necessarily exclude the presence of a tumor; but the fact that there is no optic neuritis does suggest doubt; and unless very clearly defined, or unless the physician feels satisfied that there is no condition present except a tumor which could reasonably be expected to account for the phenomena of the case, he will be wise, in the absence of double optic neuritis, to hesitate before committing himself to a positive diagnosis."

In this case there was absolutely no changes in the disc and vision was as perfect as in the other eye. There was a small hemorrhage in the outer inferior quadrant and this was probably due to the atheromatous condition of the blood vessels on association with renal disease.

In June, 1904, issue of the *American Journal of the Medical Sciences*, Dr. Chas. A. Oliver, of Philadelphia, has a very interesting report of a case of "Cerebellar Neoplasm in a Subject with Renal Disease." The growth proved to be a sarcoma, and while it was situated in the cerebellum, it nevertheless extended down into the pons varolii and medulla, and in this way involved some of the nervous structures which were affected by the growth just as in my own case. In Oliver's case, as was to be expected from an intracranial growth, there was a neuro-retinitis in both eyes but more pronounced in the left. In describing the eye symptoms of this case when first seen, Dr. Oliver has this to say: "A medium degree of paresis of the left external muscle together with a slight paresis of the corresponding orbicularis muscle could be determined both objectively and subjectively. There was imperfect action of the muscles which were supplied by the left oculomotor and pathetic nerves." In giving the gross findings at the post-

mortem, Dr. Oliver says the apex of the growth was nipple shaped and projected forward to a point which was situated slightly anterior to the middle line of the pons varolii and reached within  $1\frac{1}{2}$  cm. of the origin of the left crus cerebri. Laterally towards the median line, the growth pressed upon the medulla, while on the left side it rested upon the posterior part of the pons varolii. The seventh and eighth nerve trunks on the right side appeared to be in good condition, while the corresponding left ones were swollen and indistinct. Dr. Oliver remarks that this case is of interest because the cerebellar growth developed in a patient suffering with renal trouble, and although the macroscopic examination showed marked destruction of the nerve elements in the neighborhood, and although complete blindness supervened with very bizarre ocular palsies, yet the cause of the patient's death was evidently uremic coma. In my own case the cause of the death was evidently uremic, as manifested by the lethal convulsions. In both of these cases a very important point arises as to what effect the growth had upon the renal disease and vice-versa what effect the renal trouble had upon the increase of the adventitious growth. Was the condition of the blood vessels and circulation damaged to such an extent by the renal disturbances as to afford good food for the propagation of a malignant growth?

In the *Annals D'Oculistique* for June, 1896, there is an article by Dr. V. Morax, entitled "Ocular Disturbances Observed in a Case of Epithelioma of the Sphenoidal Sinus." in this case the malignant growth extended much more rapidly from the sphenoid sinus into the contiguous cavities than in the case reported by me, consequently there was a considerably more destruction of the surrounding parts and more marked subjective and objective symptoms. The case reported by Dr. Morax is certainly interesting and instructive enough to allow here an abstract of the same: M. V., 53 years old, presented himself at the clinic May 12, 1893, complaining of complete blindness of several days' duration. The commencement of the ocular trouble dated back to the beginning of 1893. Examination of the patient showed that the ocular movements were normal. The pupils were unequal and reacted neither to light nor accommodation. The fundus of the eye showed no lesion. Visual perception abolished

in both eyes. He had severe and continuous headaches. Later slight optic neuritis, then atrophy of the disc. In the beginning no naso-pharyngeal disturbance, later purulent discharge from the nose and appearance of pedunculated tumors on the pituitary membrane. Paralysis of the oculomotor nerves. Ptosis, exophthalmos from intraorbital tumors. Death one year after the commencement of the affection from broncho-pneumonia. Autopsy: Primary epithelioma of the sphenoidal sinus with dilatation of the sinus. Invasion by the neoplasm of the body of the sphenoid, of the optic nerves, and of the chiasm. Neoplastic prolongation into the orbit, the maxillary sinuses and the ethmoidal cells. Invasion of the orbital surface and the frontal convolutions. Broncho-pneumonia. As will be seen, there were several symptoms somewhat analogous in this case to the one reported by me, and I doubt not that if the uremic condition had not intervened and caused death the tumor in my own case would have extended and produced very much the same chain of symptoms. It is also noteworthy that death in Dr. Morax's case was attributed to broncho-pneumonia and not to the tumor itself. Morax also refers to a case of carcinoma of the sphenoidal sinus described by Albert in his *Lehrbuch der Chirurgie*, in which he says: "Affections of the sphenoidal sinus are not commonly manifested by the recognizable signs. I once saw the sphenoid sinus completely filled with a decomposing carcinomatous mass without the slightest symptom having been observed during life." Morax thinks that this case was nothing more than an empyema of the sphenoidal sinus and he closes with this significant remark: "We see, therefore, that documents are completely lacking and we must be content to record cases until a sufficient number are brought together to enable us to sketch the principal clinical symptoms which will lead to a recognition of neoplasms originating in the sphenoidal sinus." The question as to the involvement of the sphenoidal sinus with an abscess or adventitious growth without at the same time affecting the optic nerves, is an exceedingly interesting question, especially since of late years more attention has been given to the pathological involvement of this sinus by both oculist and rhinologist. Considerable original work on this question has been done by Onodi and Eversbuch in Germany. In a very extensive ar-

ticle accompanied by anatomical plates, Professor Onodi has gone very thoroughly into this question and has published the same in the December, 1904, issue of the *British Journal of Laryngology*. I shall take the liberty of quoting freely from this monograph.

In this article, Prof. Onodi has undertaken to show the close anatomical relationship between the optic nerve and the posterior accessory sinuses, especially the sphenoid, and also from this anatomical relationship any disturbance of vision is likely to occur when these sinuses are the seat of very severe pathological changes, such as abscesses, adventitious growths, etc. In numerous dissections Prof. Onodi found that there was a great variation in these relations and has thus summarized his findings:

1. The optic canal may be formed on both sides by the sphenoidal cavities.
2. The optic canal may be connected on both sides with the most posterior ethmoid cells only.
3. The optic canal may be formed on one side by the sphenoidal cavity, on the other by the most posterior ethmoidal cell.
4. The optic canal only on one side may be related either with the sphenoidal cavity or with the posterior ethmoidal cell.
5. The optic canal may be related on one side both with the sphenoid cavity and with the posterior ethmoid cavity.
6. The optic canal may be related neither with the sphenoid nor with the posterior ethmoid cavity.

From this summary it will be seen that the optic canal when seen in the close relationship with the sphenoidal cavity or the posterior ethmoidal cells, is always in imminent danger of injury with a consequent involvement of the optic nerve should these sinuses become affected. However, it must be borne in mind that it takes very gross pathological lesions of these sinuses to cause injury to the optic nerve, and fortunately when such lesions or abscesses do occur, they always have a tendency to drain themselves through their natural openings into the naso-pharynx and nose rather than to empty themselves above, forward and outward into the orbital cavity.

Berger and Tyrmann have published a monograph on the connection between diseases of the sphenoid cavity and blindness. Up to 1886 they had collected 23 cases only from the

literature, and Onodi remarks that "since that date very little has been written in text-books of the eye and nose, as to the diseases of the sphenoidal cavity, producing by its close relationship with the optic nerve, blindness and nasal defects." The important fact was established by Berger and Tyrmann in their statistics that "no defect in vision has been shown in a number of cases, during the whole course of the affection of the sphenoidal cavities, in caries or in the growth of a tumor, up to the death of the patient." Consequently in making a diagnosis of the involvement of the sphenoid cavity with some pathological condition we should never wait until the optic nerve has become involved, as that always shows an extension of the process to a point where treatment will prove of but little avail.

Should the optic nerve become involved as the result of such pathological conditions, it is usually an optic neuritis and that too unilateral.

Lapersonne has this to say: "Optic neuritis is rarely seen in inflammation of the frontal sinus, more often in inflammation of the maxillary or ethmoid, but is produced, if at all, by inflammation of the sphenoid sinus. A chief characteristic of neuritis due solely to sinus inflammation, is that it is unilateral. Although strictly speaking both nerves may be affected in the optic canal by the inflammation of both sphenoidal sinus, a double edematous neuritis ought rather to make one think of an intracranial process."

It is not surprising that in the case here reported by me, the optic nerve was not involved although there was marked exophthalmos, protrusion into the naso-pharynx, etc., because the post-mortem examinations findings in other similar cases show the rarity of such an involvement. For instance, Onodi says "Post-mortem examinations show that tumors in the region of the body of the sphenoid leave the optic nerve intact." Reinhardt has reported that in case of cancer of the upper jaw, the bones of the cranium being greatly thinned by caries, the body of the sphenoid being so softened that it could be cut away with a knife, the post-mortem findings showed that the optic and olfactory nerves were normal.

Ponfick mentions a case where "a sarcoma had originated in the body of the sphenoid, and the optic nerve, though involved in the tumor, was normal." Onodi says that he and

Schmidt-Rimpler have reported cases which show that "in cases of sarcoma of the sphenoid, both optic nerves may remain intact."

Even cases have been reported where severe suppuration of the sphenoidal cavity has occurred with the simultaneous destruction of the bone, and yet there was no disturbance of vision.

Baratroux describes a case in which a large part of the sphenoid was extruded through the nose without any consequent interference in vision. Hajek saw in several cases, considerable syphilitic affection of the anterior wall of the sphenoid cavity without any special optic nerve symptoms. Flatau records 26 cases of empyema and caries of the sphenoid cavity, but mentions no interference with the sight.

Foucher also describes a case of a girl 15 years old, where necrosis of the turbinate bodies and sphenoids were found, where the patient died and yet the vision was not affected. Dr. Hinkle has reported 20 cases of sphenoidal empyema treated, where there was no involvement of the eyes.

In studying the literature of diseases of the sphenoidal sinus, it would seem to be the exception for the eyes to be involved even in the most severe pathological conditions.

This subject is certainly one of great importance and the study of it still in its infancy, so that we must have a report of every pathological condition which will aid us in the elucidation of this subject. As Prof. Onodi says in concluding his article from which I have freely quoted: "I have put together on the basis of my investigations, all the material at my disposal, to explain the present day position of the question, to point to this question waiting for solution, to draw general attention to this interesting and important subject. Whilst I commend these questions to the special attention of the ophthalmologists, I shall hope that the joint rhinological and ophthalmological study of this subject, in many respects still unknown, will lead to successful enlightenment."

## ABSTRACTS FROM CURRENT OTOLOGIC, RHINOLOGIC AND LARYNGOLOGIC LITERATURE.

### I.—EAR.

#### **The Operative Treatment of Purulent Meningitis Following Inflammation of the Labyrinth.**

WITTMAACK, Jena (*Münch. med. Wochenschr.*, No. 47, 1908), shows that all cases of meningitis following inflammation of the labyrinth are not necessarily fatal if properly dealt with. In two of his cases where the diagnosis was confirmed by spinal puncture, the Neumann labyrinth operation, followed by a free incision of the cerebellar dura from the sinus to the porus acusticus, resulted in recovery. Great weight is laid upon early diagnosis, spinal puncture, radical operation and incision of the dura.

*Horn.*

#### **The Use of Pyocanase in Acute Suppuration of the Middle Ear.**

LEUWER, Bonn. With this new preparation, here in Germany so widely experimented with as a treatment for angina, diphtheria, etc., Leuwer found that his results were not better than by the usual methods with boric acid. Complications were not prevented and cases came finally to operation in the usual number.

*Horn.*

#### **The Treatment of Traumatic Defects of the Lobe of the Ear by Means of Plastic Methods.**

SCHMIEDEN, Berlin (*Berlin. klin. Wochenschr.*, No. 31, 1908). In the case of a boy with entire loss of the external ear the author successfully built a new ear by the following series of operations, fourteen days apart:

1. Excision of cartilage from the right ribs and free implantation under the skin of the breast.
2. Enveloping the cartilage with the skin of the breast, in the general form of the ear.
3. Formation of a long flap with the base in the region of the clavicle. The flap was then turned up and sewn in place.
4. The base of the flap was cut through and the breast scar made smaller.

*Horn.*

**Rosenmueller's Fossae and Their Importance in Relation to the Middle Ear.**

FRANCIS P. EMERSON, Boston (*Boston Med. and Surg. Jour.*, April 23, 1908). A further study of one hundred cases in adults, showing the relation of Rosenmueller's fossae to diseased conditions of the middle ear, confirm the conclusions, viz.:

1. Pathologic amounts of lymphoid tissue are present in Rosenmueller's fossae in a large number of cases of chronic secretory and suppurative ears.
2. This cannot be detected with certainty by posterior rhinoscopy alone, even where a good view of the vault is obtainable.
3. In every chronic case there should be a routine digital examination.
4. Where much tissue has been found and removed, the process of healing should be watched that no fibrous bands form.
5. It is possible in a large majority of cases to predict the involved ear by the condition of the corresponding fossa.
6. Results, where after-treatment is followed, are particularly good in removing abnormal sensations, restoring uniform hearing without fluctuations in the partial or complete relief of tinnitus, and in the prevention of recurring salpingitis.
7. If directions are given to blow one side of the nose at a time and carefully, the affected tube is no more apt to be infected later than its fellow.

Outside of the cases of otitis media suppurativa chronica, the symptoms are associated with chronic secretory ears having the following definite symptoms: Stuffiness, fluctuating hearing, low pitched tinnitus and recurring unilateral salpingitis. There is no age limit, and under the above conditions it is almost invariably present.

*Richards.*

**The Treatment of Acute Catarrh of the Middle Ear.**

WALB, Bonn (*Deutsch. medizin. Wochenschr.*, No. 47, 1908). In the course of a paper on this subject, the author drives another nail into the coffin of Bier's method of the treatment of purulent ear disease and mastoiditis by means of passive hyperemia. Based on the study of twenty cases, Professor Walb is at one with almost every other specialist in Germany, that the rubber cravat in this condition is about as

safe as a stick of dynamite in the hands of a child. Keppler, who was a surgical assistant of Bier's and not a trained otologist, published the first paper on the subject, and was followed by Eschweiler of Bonn, who also in his first, but more especially in his latest paper, led the otologic world to believe that in the treatment of mastoiditis the knife was to be relegated to the ash-barrel, and that the millennium in the treatment of this disease had been reached by the use of the elastic neck-band.

It soon appeared that in other parts of Germany, men uninfluenced by local conditions, were unable to obtain any such brilliant results, and reports of deaths from thrombosis of the sinus and unfavorable operative conditions followed one other in rapid succession. Not until the present paper appeared was it shown that these twenty cases studied in Bonn during 1905-06 were as unfavorable as the others, and on account of the dangerous conditions which followed this method of treatment the author suggested that it should only be carried out in a hospital under trained eyes.

Horn.

#### Purulent Inflammation of the Inner Ear.

UFFENORDE, Göttingen (*Medizin. Klinik.*, No. 39, 1908.) In a clinical lecture he reviews clearly the diagnostic difficulties of varying grades of inflammations in the cochlea and semicircular canals. He claims that labyrinth inflammations occur in 1 per cent of all middle ear inflammations or more commonly than sinus phlebitis, meningitis and brain abscess together. The paths of infection in the order of their commonness are the prominence of the lateral semicircular canal, the oval window, the round window and the promontory. He believes that in one case the Fallopian canal acted as the path of the infection. The experience of the last ten years seems to have settled beyond a doubt that the cochlea alone is concerned in the perception of sound, while the vestibular apparatus concerns itself with the ataxic function alone. The physiologist Hensen alone clings to the old theory that the vestibular apparatus is connected with the function of hearing. He casts some doubt on the methods of Barany, claiming to have had cases of undoubted defects in the semicircular canal system, where he was able to produce caloric rotary and galvanic nystagmus. (See *ANNALS* for Dec., 1907,

Barany, "Methods of Examination of the Semicircular Canals.") The diagnosis of purulent inflammation of the labyrinth is of very great importance. The mortality from non-operated cases is very high. If in these cases the symptoms of labyrinth irritation do not quickly disappear by conservative methods, we must proceed at once to operation. The mere determination, however, of a labyrinth inflammation is not in itself an indication for the labyrinth operation, or even the radical operation. A local inflammation can take place in one part of the labyrinth and be cured without involvement of the whole structure. His indications for labyrinth operation are when meningitis serosa, deep-seated extradural abscess, or cerebellar abscess complicate the labyrinth inflammation. A purulent meningitis determined by the lumbar puncture is not now a contraindication. The invasion of the internal ear by a cholesteatoma or a tuberculous process is a distinct indication. In other cases our individual experience and the results of the previous radical operation must determine the course of events. In closing he gives his own method of total ablation of the labyrinth by means of a preliminary laying bare of the facial nerve in its Fallopian canal.

*Horn.*

**The Modern Methods of Investigating the Vestibular Apparatus and Their Practical Meaning.**

BARANY, Wien (*Mediz. Klinik.*, No. 50, 1908). In the ANNALS for December, 1907, this well known investigator described, for the first time in English, his newly discovered methods of examining the labyrinth. In the present paper he lays more weight on the side which appeals to the general practitioner and shows how a careful observation of eye nystagmus, in cases where dizziness, vomiting or nausea seem to arise from a genital trouble or a stomach complaint, might save the physician from making a terrible mistake and sacrificing the life of the patient. The value of the method in medico-legal investigations is also shown and how a proper use of the same would exclude all simulated dizziness on the part of the patient. For a full elucidation of this most important subject, the reader is referred to the original monograph. "Barany—Physiologie und Pathologie des Bogen-gang-Apparates." Faanz Deuticke, Wien. Price, Marks 2.50. (Bound in paper.)

*Horn.*

## II.—NOSE.

**The Operative Treatment of Nasal Septum Deformities.**

KRETSCHMANN, Magdeburg (*Muen. med. Wochenschr.*, No. 41, 1908), proposed, at the last annual meeting of the German Otological Society, to substitute for the ordinary submucous septum operation, a proceeding of such surgical magnitude, that the paper was not regarded at all seriously. By gaining access to the nose through the mouth, that is by making a long incision under the upper lip, raising up the periosteum to the *apertura pyriformis*, making a circular incision of the mucous membrane in both nostrils and with a strong retractor pulling this portion of the face up over the nose, the author claims to have a freer access to the septum than is possible even by the Freer submucous method! A claim that hardly anyone would deny him. That a general narcosis must be used, that "usually severe hemorrhage takes place," to be controlled, as the author recommends, by a combination of artery forceps, compression,  $H_2O_2$ , and various astringent powders, as well as adrenalin, are mere details. The author found the intubation narcosis, of Kuhn, with a tight tampon in the nasopharynx the safest and prevented the aspiration of most of the blood. The cut is carefully sewed up, rubber drains are inserted in both nostrils and the patient remains, under favorable conditions, in bed for "3-4 days." There is a severe swelling of the face and eyelids in a few days, the patient keeps a stiff upper lip for some time, but the end result is satisfactory.

For additional details, we refer the reader to the original.  
*Horn.*

**Methods of Transillumination of the Sinus Frontalis and Antrum of Highmore.**

VOHSEN, Frankfurt (*Berlin. klin. Wochenschr.*, No. 28, 1908), describes his new transillumination lamp, which contains a rheostat in the handle. In comparing the two sides, he first investigates the healthy sinus and noting the amount of current necessary for a clear outline, uses the same amount of current for the other side. If now a clear outline is not obtained and more current is necessary, he is in a position to look with suspicion on the darkened sinus. His technic seems

to be a distinct advance over the ordinary happy-go-lucky methods which has thrown such discredit on the value of transillumination.

*Horn.*

**The Use of Potassium Iodid in Diseases of the Accessory Cavities.**

HEMPPEL (*Berlin. med. Wochenschr.*, No. 39, p. 1769, 1908) has had good results in acute as well as in chronic cases by the use of potassium iodid. Its value in these conditions, although perhaps but little noted in the literature, has long been known, and it is by no means new.

*Horn.*

**The Value of the X-Rays in Rhinology.**

SCHEIER, Berlin (*Deut. med. Wochenschr.*, No. 41, p. 1767, 1908). In a paper read before the International Rhinolaryngological Congress in Vienna, 1908, the author shows the place the Röntgen photography holds in the diagnosis of diseases of the accessory sinuses. Unfortunately, with other authors, he belittles the value of transillumination, and fails to mention the fact that such a thing as a suction apparatus exists. Surgeons were able to diagnose fractures before the advent of the X-ray; and rhinologists, who are not always in a position to have a photograph made, are still able to recognize the absence of a frontal sinus, without an unnecessary operation.

*Horn.*

**The Relation Between Diseases of the Nose, With its Accessory Cavities, the Nasopharyngeal Cavity and the Eye.**

KUHNT, Bonn (*Deut. med. Wochenschr.*, No. 37, 1908). In the International Laryngo-Rhinological Congress at Vienna, last-year, the author of our present methods of radically combating the pyogenic diseases of the frontal sinus and ethmoid labyrinth, discussed, under the above title, a subject of vast importance, and shows how closely bound together is the work of the rhinologist and laryngologist. It is impossible to here review in detail all of the interesting points brought out in this long paper; the mechanical and circulatory disturbances of the eye, with its changes in conjunctiva and cornea; the inflammatory intraocular diseases; the influence on glaucoma; on Basedow's disease; the retinal changes, especially retinal

detachment; the remarkable changes in the field of vision for red and green which occurs in almost every case of acute and chronic accessory sinus disease, are matters which deserve most careful study.

*Horn.*

**The Diagnosis and Treatment of Suppurative Conditions of the Accessory Sinuses.**

MARTENS (*Deutsche medicinische Wochenschrift*, January 28, 1909). The experience of the physician in regard to the frequency of diseases of the accessory nasal sinuses differs very decidedly from the pathologic findings at autopsy. At autopsy diseased conditions of the sinuses are found much more frequently than was suspected during life. One reason for this is that many suppurative processes of the sinuses cause so little suffering that the patient does not seek the advice of a physician. In certain cases also the diagnosis presents many difficulties.

Aids to the diagnosis of affections of the accessory sinuses have increased very much during the past few years. Transillumination and skiagraphy are of the greatest service. Trial punctures of the antrum of Highmore are made, and the naso-frontal duct is made more patent so that pus in this region can be more readily detected.

The ethmoid cells offer the greatest difficulties to intranasal manipulations.

In ethmoid disease, unless pus can be seen coming directly from the cells, repeated examinations may be necessary to make a diagnosis, and if the patient and physician lack the necessary amount of patience, many cases of ethmoiditis may be overlooked.

The subjective light reflex, and skiagraphs may point to the disease, but after all, the surest indication is the presence of pus in the nose.

In cases in which no pus can be found on nasal examination the suction method, which has been advocated by certain authors for years, will draw out even the smallest quantity of pus. This is particularly true in disease of the ethmoid cells.

The writer recommends for this purpose the use of a specially constructed pump with a vacuum meter, with which a uniform pressure can be maintained.

He has been able to demonstrate the presence of pus in certain cases in which absolutely none could be found in the nose before the suction pump was used. It is particularly useful in disease of the posterior ethmoid cells and sphenoidal sinus, conditions often presenting great diagnostic difficulties.

It is also of great value in the treatment of suppurative affections of the sinuses. The main object of the treatment in acute cases is to get the pus out of the sinuses; and this, the author states, can be readily accomplished with the suction pump.

*Theisen.*

**The Sphenoidal Sinus; a Study Based on the Examination of Eighty-five Specimens.**

JAS. A. GIBSON, Buffalo (*Jour. A. M. A.*, December 19, 1908). The transverse diameter is slightly greater than the antero-posterior: when the expansion of the air chamber takes place in the anterior direction, it usually does so as enlarged posterior ethmoid cells. The average antero-posterior diameter of 81 specimens was 23.25 mm (24/25 inch); transverse diameter of 70 specimens was 29 mm (1 3/16 inch); vertical diameter of 75 specimens was 18 mm (3/4 inch). Thickness of anterior wall averaged .25 to .50 mm (1/100 to 1/50 inch); the roof varies from .25 mm to 1 mm and over, rarely 2 mm; the floor is usually thicker than either of the other boundaries, being always thickest posteriorly and ranging from .25 mm to 9 mm (1/100 to almost 1/3 inch). The thickest part of the posterior wall is always found on the same level as the floor: this wall varies in thickness from .25 mm to 10 mm (1/100 to 2/5 inch). The anterior wall of the sinus usually projects in front of a plane drawn vertically through the hamular processes. The bony wall between the optic foramen and the sinus is very thin, varying from .25 mm to 1 or 2 mm. In eighty specimens the distance between the anterior wall of the sinus and the anterior nasal spine varied from 45 mm to 71 mm, the average being 57 mm (2 1/2 inches).

The lamina separating the two sinuses may be displaced either to the left or right and is frequently obliquely placed: no communication was found between the sinuses. The least distance from the anterior nasal spine to the posterior wall of the sinus is 57 mm (2 1/8 inches). An instrument may be

inserted to this distance without fear of entering the cranial cavity.

*Richards.*

**The Present Status of The Radical Operation for Empyema of the Sphenoid Sinus.**

ROSS HALL SKILLERN, Philadelphia (*Jour. A. M. A.*, December 19, 1908). A modified hook for opening the ostium sphenoidale and a modification of the Hajek bone forceps are used. After cocaine anesthesia with 20 per cent solution and adrenalin the posterior half of the middle turbinate is removed with scissors and cold snare: the posterior ethmoid cells are then broken through with Hajek's ethmoid hook, the debris being removed with a conchotome or similar instrument. The ostium being visible, the evulsor is introduced and the ostium opened 8-10 mm. in diameter. The bent forceps of Hajek are now used and as much bone removed as is necessary to ensure a permanent opening, which should reach to the floor of the sinus. Granulations, if present, should be let alone for two weeks, when if they have not subsided under free drainage they may be curetted, but never on the superior and lateral walls.

*Richards.*

III—LARYNX.

**Isolated Paralysis of the Musculus Rectus Externus With Purulent Middle Ear Disease on the Same Side.**

PEYSER, Berlin (*Berlin. klin. Wochenschr.*, No. 26, 1908). Based on a study of his own case and others gathered from the literature, the author comes to the conclusion that paralysis of the abducens takes place from the purulent middle ear disease, per contumaciam, by way of the soft parts.

*Horn.*

**Fundamental Principles in the Treatment of Laryngeal Tuberculosis.**

BOURACK (*Archives Internationales de Laryngologie*, July, 1908, to January, 1909) begins by speaking of the number of articles which have appeared upon this subject in the last five years and of certain new procedures which have to a certain extent taken the place of the older methods. He refers to the

teaching of only twenty-five years ago, that laryngeal tuberculosis was an incurable infection. The surgical treatment has been bitterly opposed and for a long time practiced by only a few men. Today, with more or less restrictions, it is employed in the majority of clinics. There are indeed even partisans of exo-laryngeal methods, "laryngotomy, laryngectomy, partial or complete, and tracheotomy." In the last few years there have been repeated in the foreign press new, skeptical views on the treatment of laryngeal tuberculosis. Today there is certainly neither the doubt and despair of 1870 and 1880 nor the enthusiasm of 1890 on the subject. One can now make his examination without partiality. Above all we can actually assert as proved the view that laryngeal tuberculosis ought to be treated energetically as a local affection and that we ought not to confine ourselves to treatment of the lungs, nor to a belief that a physico-dietetic treatment is sufficient. Great attention should be paid to the condition of the lungs. The observations of the last ten years show that pulmonary tuberculosis, especially fibroid forms, can be healed; nevertheless the lesion of the larynx is an independent one as is shown by the fact that we can get healing here while the disease in the lungs advances. This destroys the argument of those who say all that is required is to get the pulmonary condition better. It must not be forgotten that laryngeal affection left to itself has a tendency to progress and spontaneous healing is a great rarity. In the majority of the most important clinics of the world the choice of medical or surgical remedies varies with the condition in the particular case. Medical treatment is, however, insufficient, as we do not know of any medical specific against it. No one has any longer the faith in lactic acid, menthol, etc., which he formerly had. Krause, the discoverer of lactic acid, today recommends intravenous injections of betol. While energetic applications of lactic acid, 50 or 75 per cent or even pure, or of para-chloro-phenol or phenol-sulforicine or the mixture of Bonain have at times produced healing, at other times they are entirely powerless. There are today few opponents of the surgical treatment of laryngeal tuberculosis, if one can judge from literature. The difficulty is to determine the precise indications for its employment. We can say, however, in general, that the cases where operative intervention is to be employed are more limited than was the case ten years ago. The debut of

laryngeal tuberculosis presents itself under such a variety of forms that no general system of treatment can satisfactorily be established, each case requires its own particular line of treatment. Authorities now insist upon one feature which cannot be overlooked—the *healing tendency* of the organ—it is due to this that the curette or galvano-cautery are a benefit at times with extensive infiltration and at other times are powerless against infiltration or against ulceration which does not appear extensive.

It is on account of this that indications for operative intervention are, according to the most recent authorities, fixed in such an uncertain manner. In general, however, the limits have, in the last years, been notably changed compared with those given by Krause. For example, Imhofer does not regard an advanced general condition and a pronounced local process as a contraindication to operation, because, according to his opinion, laryngeal tuberculosis is curable in the advanced stages. Kuttner operates even when the laryngeal lesions are extensive.

Bezold formerly operated for a bad general condition particularly with the aim of relieving the patient when suffering from dyspnea and dysphagia, but after a number of failures he has become more prudent in the choice of his cases; he no longer operates when the erosions are of slight extent, if the infiltrations are not ulcerated and if the process does not present any signs of rapid advance. On the other hand, he hastens to operate in cases where the infiltration shows a distinct ulceration and is commencing to advance, if there are ulcerated indurated borders and if there is a tubercle under the ulceration. Contrary to Mermod and Grünwald, he does not use the galvano-cautery except rarely, never when the infiltration and inflammation are extensive. From his experience as director of the Sanitorium of Falkenstein, he has no confidence in tracheotomy and believes all exo-laryngeal methods involve too much risk.

Gleitsmann announced in 1903 the following indications for curettage: First—primary laryngeal tuberculosis. Second—limited infiltration and ulceration. Third—indurated infiltration of the interarytenoid space and infiltration of the arytenoid cartilage and the false vocal chords. Fourth—in the initial stages of pulmonary affection. Fifth—in advanced pulmonary tuberculosis with dysphagia, the result of inflammation of the arytenoid.

Heryng in the first years of his enthusiasm operated even upon the most advanced cases, but in recent years he has become more circumspect and gives the following indication for operation: First—tubercles of the epiglottis. Second—chronic infiltrations of the posterior wall. Third—chronic tubercles upon inflamed tissues resisting other methods of treatment. Fourth—affection limited to one region of the larynx.

Krause operates also in cases of diffused infiltration of the false vocal chords, posterior wall and epiglottis and in extensive ulceration when there are extensive lesions in the lungs.

The Vienna school is in general more conservative than is the Berlin school.

Hajek does not operate except when there are very small ulcerations and the general condition is satisfactory.

At the meeting of the Laryngological Society of London, the majority of those present expressed themselves in favor of the endo-laryngeal methods in the treatment of laryngeal tuberculosis.

Semon regards perichondritis of the arytenoid and edema as contraindications, and that success is less likely where there is general inflammation.

Levy uses curettage in cases of limited ulceration and not alone in cases of ulceration which show a tendency to advance. He advises excision in cases where one can hope to be able to entirely remove the diseased part and the galvano-cautery in cases of superficial ulceration of small extent. Tracheotomy can be employed in others, but never total resection.

Finder and Alexander, from the clinic of B. Fraenkel, recommend curettage particularly in tubercles and ulceration of limited extent and they regard advanced pulmonary trouble as an contraindication. They never touch indurated infiltrations on the posterior wall. The best results, according to Finder, are obtained by the use of curettage where there are ulcerations of the false and true vocal chords of epiglottis. Exo-laryngeal methods have not been received with great favor.

Blumenfeld reported fifty-four cases of laryngotomies performed for tuberculosis.

Gluck, out of two hundred and fifty cases, has done thirteen for tuberculosis; in eleven of these there was a good result obtained.

Exo-laryngeal methods are recommended by many authors

in cases of laryngeal tuberculosis in cases of pregnant women. Contrary to the usual impression, such a condition in pregnancy is not rare; almost all the patients die after confinement.

Tracheotomy has rarely had a favorable action, probably because it was practiced too late.

Authorities differ about the advisability of performing an abortion. Tracheotomy has been recommended as a therapeutic means in laryngeal tuberculosis since 1868.

M. Schmidt in 1897 gave the following indications for tracheotomy: First—laryngeal stenosis. Second—grave lesions of the larynx if the lungs are not seriously affected in the absence of stenosis. Third—the rapid progress of the disease before the appearance of dyspnea. Later, Schmidt does not insist upon the indication furnished by the lungs.

Chiari believes an early tracheotomy has a favorable effect not only upon the evolution of the laryngeal affection, but also upon the pulmonary affection. Nevertheless in adults, in spite of the great authority of Schmidt, tracheotomy plays an inconsiderable role in the treatment of laryngeal tuberculosis. The operation has been condemned by MacKenzie.

Krause asserts that by immobilization of the diseased organ, one can hope theoretically to obtain improvement in the local condition, he has, indeed, witnessed two favorable actions. These favorable results are, however, rare as a rule when the condition of the lungs is advanced. Generally when employed, after the operation the expectoration becomes more abundant, the disease advances and the suffering of the patient is, at times, greatly increased.

Mermod is also opposed to tracheotomy, especially as he has observed two cases of extensive ulceration around the tracheal wound. The other methods, *electrolysis, cauterization and incision* are of much less importance.

Mermod was at one time enthusiastic in the use of electrolysis but he has now abandoned it, except in advanced cases on account of the time necessary. He employs the monopole cathode introduced into the larynx with a current of fifteen to twenty milliamperes and also employs it in the case of voices of professionals when redness or slight infiltration of one of the vocal chords exists. The *incision* is also very little employed today. The most frequent form of surgical treatment is the *curette*.

More recently the employment of the galvano-cautery has come forward.

Grünwald, in a recent article (1907), recommends warmly, deep cauterization for the purpose of destroying morbid tissue, thus avoiding, as far as possible, any reaction in the tissues and without destroying, without definite object, the mucosa in order not to give a channel for the spread of the affection. Where the lesions are well defined, and particularly when situated in the interior of the larynx, he practices laryngo-fissure. In affection of the vestibule of larynx, and especially in the lower portion of the pharynx, he practices subhyoid pharyngotomy. If there is perichondritis, he practices a partial resection. If there is grave stenosis, he practices tracheotomy.

Mermod makes use of cauterization in many hundreds of cases, even in those with grave complications.

He has abandoned curettage since he had two severe cases of hemorrhage. One advantage of the galvano-cautery over the curette and cutting instruments is its small diameter. In his opinion it is necessary to destroy all the diseased tissue which is accessible to the eye and instrument. It makes no difference to him whether the infiltrations are ulcerated or not. Many months are often necessary because long intervals have to elapse between treatments. He believes that the indications for its use should be enlarged to the greatest possible degree. He has, indeed, obtained good results in cases which seemed to be most desperate. He does not give any precise indications, but takes into account, as do Finder and the others, the healing tendency. In short, he often fixes the indications *ex juvantibus et nocentibus*. If the operation increases the trouble, there is little probability that one can obtain success; but in the sluggish cases he believes in energetic local treatment not only with the aim to heal, but at least to relieve the suffering of the patient. He has observed ten cases where the laryngeal affection remained for a long time the only manifestation of tuberculosis. Out of 280 cases treated by galvano-cautery 60 have remained healed for a year after the operation; 40 for more than two years; 17 for more than three years; and one has had no return in 16 years. In recent years attention has been turned to *photo-therapy, x-ray and radium*. The results, unfortunately, do not allow us to form any opinion at present as to their value.

As a conclusion of the foregoing we can say that up to the present time we have no method which is a sure cure for laryngeal tuberculosis. Nevertheless we can not question that

energetic treatment often obtains good results where expectant treatment would allow the patient to perish. In our treatment the patient should be placed under the most favorable climatic and hygienic conditions, employing the best surgical means at our disposal, generally curettage or galvano-cautery. Sur-alimentation is of the greatest importance and to that end all the functions of the stomach and intestines should be looked to. Constipation should be avoided; proper breathing through the nose is essential. All of these measures can be more easily applied where the patient can receive the constant attention of a physician and is subject to a regular régime. This can be best done in a sanatorium. The climatic conditions of the sanatorium play an important role. It is, then, of the first importance to take into consideration the form of the affection when one advises a removal to a particular altitude. This will depend upon the form of the affection—whether it is torpid, the cough dry or the expectoration abundant. First—we have a choice of treatment by pure air. Second—treatment by the sun's rays. Third—treatment by elevation and altitude. Fourth—by sea air and sea baths. Air rich in ozone is desirable, humid air is to be avoided. The patient should be protected from the cold north winds and placed where cloudy days are not frequent nor changes in temperature sudden. The importance of solar baths is today admitted. Authorities differ regarding the advantages of mountainous airs for patients with febrile symptoms and affected with congested form of laryngeal tuberculosis. It is a fact that dry mountainous air has a good effect on patients who suffer from abundant expectoration, while sea air is much more desirable for patients who have a dry cough. The sea air is badly borne by those who suffer from congested forms. Chronic and pronounced laryngeal catarrh, which is often found, ought to make us think of the possibility of tuberculosis, especially in those of an early age. With these general measures it is important to employ local treatment. From a critical study of the various published works and from my own personal observations, we should proceed as follows: During the first few weeks no operative intervention should be undertaken. The patient can employ at home, many times a day, disinfecting and inhalation treatments. Further, we can use injections or cauterizations by using lactic acid or formalin or a mixture of lactic, chromic and formalin or a mixture of lactic, formalin and phenic acid or by methylene blue.

It is important to recommend to the patient to avoid all fatigue from voice use.

Körner has, in a recent communication, recommended iodide of potassium. If this medical treatment does not answer and if limited infiltrations should have a tendency to ulcerate, especially when they are located on the true vocal chords or in the arytenoid space or upon the epiglottis, the employment of the curette is indicated. This should be used with confidence and energy after thorough anesthesia. Such an operative treatment should not be undertaken when we are dealing with congested forms if the pulmonary lesions are deep, but we should not be stopped by this contraindication. In cases of granulation, which precede stenosis, we must not wait too long. When it is possible we should remove the granulation with cutting forceps. In the case of superficial infiltrations upon the epiglottis or the vocal chords, especially if diffused on the free borders, and if the affections are found below the vocal chords, the curette is insufficient. It is necessary then to employ the galvano-cautery. Nevertheless, when one knows how to make use of the curette it can also be used when the process is largely extended, when for example there are large ulcerations of the epiglottis, false vocal chords and the arytenoid space. In the case of large and profound infiltrations we can attempt the destroying of them by deep cauterization. Vegetations of the posterior wall of the larynx, which, as we know, often proceed for a long time without ulcerating, ought, by preference, to be left alone, at least if they do not show any tendency to break down and if the functional troubles resulting do not become more severe, producing loss of voice and painful dyspnea. If the operative intervention is badly borne it will be necessary to abandon it. When there is danger of suffocation as a result of the infiltration and granulation, tracheotomy will have to be performed if the physician is opposed to curettage.

*Harris.*

## BOOK REVIEWS.

### *De Krankheiten Der Oberen Luftwege.*

BY MORITZ SCHMIDT AND EDMUND MEYER. Fourth Edition.

Published by Julius Springer, Berlin. Price, bound, 22 Marks; postage, 2.10 Marks.

A new edition of this most popular of all German text books on the Diseases of the Nose, Throat and Upper Air Passages, will be greeted with pleasure by its old friends and is certain to make many new ones.

The recent death of Moritz Schmidt led us to fear that the former edition would be but an insufficient monument to his name. Prof. Meyer, his friend and pupil, has undertaken the editing of the new volume, which while retaining the general form of the old, has given us a strictly modern text book.

Moritz Schmidt's original aim was to put a book into the hands of the general practitioner, which would enable him not only to appreciate the close relationship between diseases of the upper air passages and general diseases, but also to recognize what he could himself properly treat and what should be sent to the specialist.

A clear and convincing style, a wealth of practical details in treatment, and the personal experiences of this great teacher, characterizes the work. It seems hardly fair to select any one chapter for review, as they are all good. The chapter on Syphilis is especially fine. A clear and lucid explanation of the Wasserman's serum reaction, an acceptance of the Spirillum as the causative factor in the disease and a general survey of the often clouded symptomology, is given.

Leukemia, Gout and many other of the rarer diseases of the upper air passages are fully treated, and special attention is given to the new growths of the larynx and trachea.

For the laryngologist, the chapter on the Nervous Diseases of the Respiratory Tract is of especial importance. One gains at once a comprehensive view of the entire subject and the lesson is so clearly taught that it remains forever in the memory.

Many have said that the book reads like a novel and truly one finishes the 700 pages with a sigh of satisfaction, for one feels that it is possible to compile an encyclopedic text book and still have it interesting.

The illustrations are all from the well-known hand of the artist Helbrig, and the press and binding leave nothing to be desired.

HORN.

**Beiträge Zur Anatomie, Physiologie, Pathologie und Therapie des Ohres, der Nase, und des Halses.**

Herausgegeben von A. Passow und K. L. Schaefer. Published by S. Karger, Berlin, Carlstrasse, 15.

The reviewer of this important contribution to the current literature of the anatomy, physiology, pathology and therapy of the ear, nose and throat, has taken the liberty of waiting until two volumes have appeared, before passing judgment on the new journal. Under the above title, Passow, the director of the Charité Clinic in Berlin, and Professor Schaefer, well known for his work on the physical and mathematical side of the physiology of the ear, nose and throat, have undertaken the direction of this journal, which seems to fill a place unoccupied by any of the other journals now in existence. It covers the more scientific and technical side of our specialty as concerns especially physics and physiology, as well as various important practical contributions regarding operations, new methods, etc.

Two volumes appear during the year, containing about 500 pages. The subscription price is twenty marks or five dollars per volume, separate numbers of which appear at irregular intervals of about six weeks.

The following selection from the list of titles well indicates what a wide range of subjects is covered by this journal and shows the importance of the scientific side of our specialty:

Band I. Über Stellung und Bewegung des Kehlkopfes bei normalen und pathologischen Sprechvorgängen. Von Priv. Doz. Dr. H. Gutzman, Berlin.

Band I. Beiträge zur Submukösen Fensterresektion der Nasenscheidewand. Von Dr. Gustav Killian, Freiburg i. Br.

Band I. Das Satyrohr eine intrauterine Belastungsdifferenz. Von Priv. Doz. Dr. Carl Springer, Prag.

Band II. Die Prognose des otischen Hirnabscesses. Von Prof. Dr. B. Heine, Königsberg i. Pr.

Band II. Beiträge zur pathologischen Anatomie der Otitis externa beim Hunde. Von Dr. R. Imhofer in Prag.

Band II. Über die Wahrnehmung der Schallrichtung. Von Dr. Kurtz Münnich in Berlin.

HORN.

**Larynx Tuberculosis and Pregnancy.**

SOKOLOWSKY, Königsberg (Sammlung aus dem Gebeite der Nasen, Ohren, und Halskrankheiten., Band IX; Heft 6.

In an exceedingly interesting and important article the author shows what a problem confronts the general practitioner and specialist, when out of 230 pregnant women, who had at the same time a larynx tuberculosis, 200 died in pregnancy of that disease, while in the 18 cases where an artificial abortion was made, 14 of these were saved.

His conclusions, with which nearly all the authorities who have studied this subject agree, are:

1. Pregnancy complicated with larynx tuberculosis, leads almost always to death. In the few that survive, 70 per cent of the children are tubercular.
2. Tracheotomy as a therapeutic measure is of little value.
3. Early artificial abortion is always indicated in pregnancy complicated with larynx tuberculosis.

Three exceptions to this rule are to be noted:

- a. In the case of tuberculous larynx tumors.
- b. Where the larynx tuberculosis appears in the last few weeks of pregnancy.
- c. Where the condition of the patient is palpably hopeless.

4. Every married woman with tuberculosis should be warned of the dangers attending conception.

HORN.

**Physiology of Voice and Speech.**

BY PROF. H. GUTZMANN, Berlin. Published by Friedr. Vieweg & Sohn in Braunschweig. Price, unbound, 8 Marks; bound, 9 Marks; Postage, Mark 0.50.

Prof. Gutzmann, in the present work, has brought together much of the important matter appertaining to the Physiology of the Voice and Speech, which was formerly only to be found in his scattered monographs. The book is a survey of recent advancements in this branch of science and is not directed alone to the physician, but to the Physiologist, Phoneticer, Linguist, Specialist for Disturbances of Speech and the Teachers of the Deaf and Dumb.

The matter is explained in the author's clear and lucid style and the 200 pages of text are all solid information. The press-work is of the best and many well selected pictures, diagrams and tables illustrate the work.

HORN.

**The Proceedings of the "Vereins Deutscher Laryngologen" for 1908.**

A. Stuber's Verlag, Würzburg. Price, Marks 7.50.

The latest developments of rhinologic and laryngologic science, as brought out in the annual meeting of the German Laryngological Society, seldom find their way into the current literature. Some very important papers were read, a detailed review of which would be here impossible. Prof. Killian in his paper on the "Diseases of the Accessory Sinuses in Scarlet Fever" brought up a subject of extraordinary interest. Von Eichborn's demonstration of the latest method of treating carcinoma of the mouth and throat by means of "fulguration," which briefly stated is the use of electrical currents of enormous tension and frequency, has led us to hope that some progress has been made in the battle against this dread disease. The other papers were of equal interest and a copy of the proceedings should find its way yearly into the library of every German-reading specialist.

HORN.

**The History of Laryngology at the University of Heidelberg.**

BY PROF. A. JURAZ. Published by A. Stuber's Verlag, Würzburg. Bound in paper; Price, Marks 3.00 (\$.75).

To the friends and students of Prof. Juraz and others interested in the historical development of laryngology this little brochure lets one into the secret of local conditions in this famous old university, and shows how, even in Germany, politics play an important role even at the expense of science.

HORN.

